NAVWEPS 16-30URM75-502

Handbook
Service Instructions

GENERATOR, SWEEP
AN/URM-75

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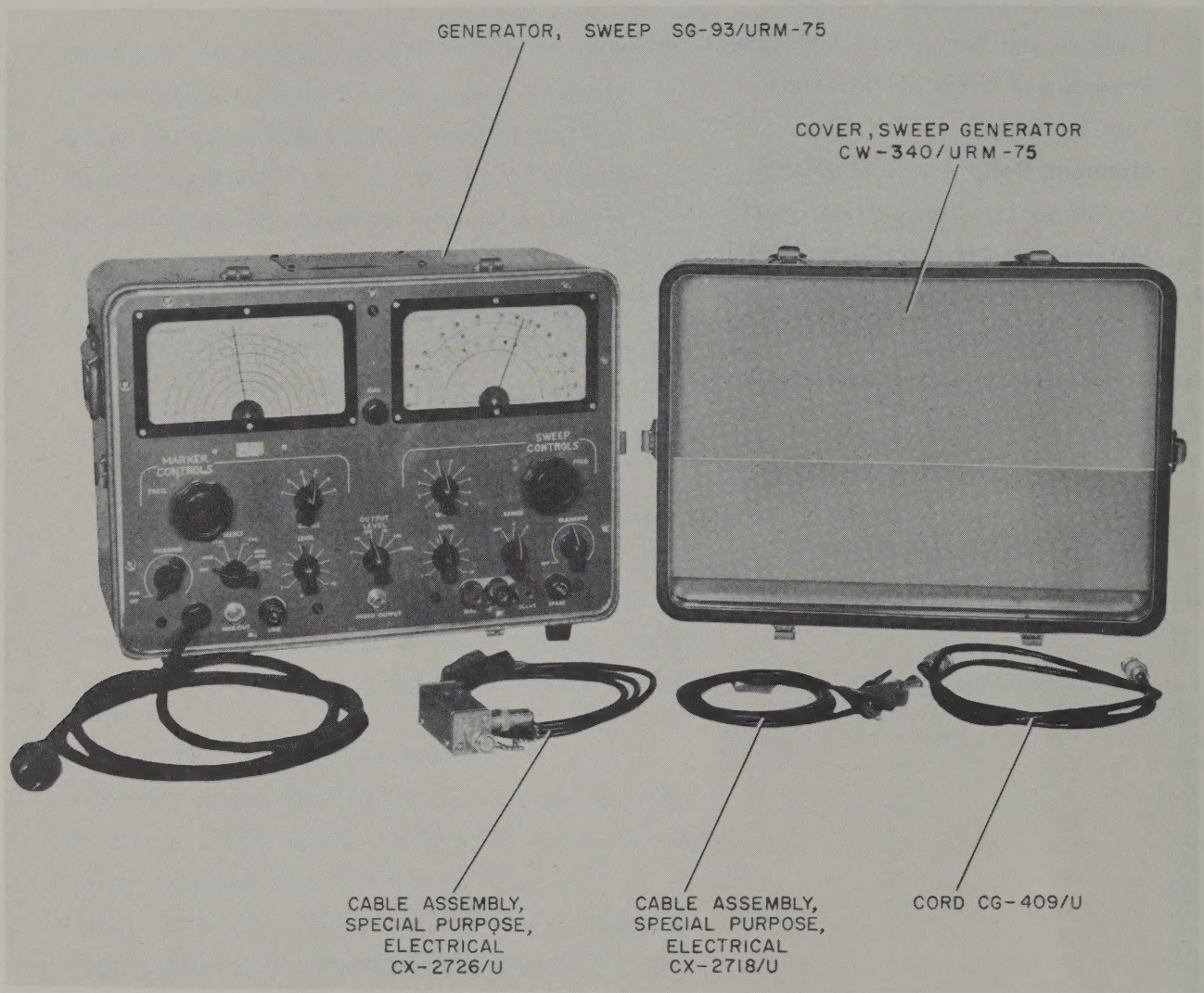

Figure 1-1. Generator, Sweep AN/URM-75, Equipment Supplied

SECTION I

DESCRIPTION AND LEADING PARTICULARS

1-1. INTRODUCTION.

1-2. PURPOSE OF HANDBOOK.

1-3. The purpose of this handbook is to provide the necessary information for the correct maintenance of Generator, Sweep AN/URM-75 by operational and organizational, and field and FASRon maintenance activities.

1-4. PURPOSE OF THE EQUIPMENT.

1-5. The Sweep Generator, shown in figure 1-1, is designed primarily to provide a frequency-modulated signal for use in visually aligning and testing of electronic equipment operating within the frequency range of the generator. In addition to the frequency-modulated signal, a single-frequency signal is also available. The single-frequency signal may be amplitude-modulated by an internal audio-frequency oscillator, if desired. A crystal calibrator circuit is also included for use in calibrating the generator itself or for furnishing external calibrating signals 10 megacycles apart.

1-6. GENERAL PRINCIPLES OF OPERATION.

1-7. The technique of visual alignment consists of applying a frequency-modulated signal to the input of the equipment under test and observing the band-pass characteristic of the equipment on an oscilloscope connected to the output. Generator, Sweep SG-93/URM-75 develops the FM signal over a wide range of frequencies by means of two oscillators, one of which is frequency-modulated. The center frequency of the modulated oscillator is continuously variable from 50 to 220 megacycles, while the frequency deviation is adjustable up to 10 percent of the center frequency. In order to produce FM signals from 5 to 50 megacycles, the output of the modulated oscillator is heterodyned with a fixed-frequency oscillator and the difference-frequency signal is used as the output signal.

1-8. Since the frequency-response curve is observed on an oscilloscope, it is necessary to provide a means of indicating frequency along the curve. This is accomplished by the marker generator, which produces a single-frequency signal from 4 to 220 megacycles, for use as a marker signal. The marker signal may be amplitude-modulated by an internal oscillator, if desired.

1-9. A built-in calibrator unit, consisting of a crystal oscillator operating at 10 megacycles, and having a high percentage of harmonics in its output signal, provides a rapid and accurate means of checking both the sweep-oscillator and the marker frequencies.

1-10. An audio oscillator operating at 600 cycles is also included to amplitude-modulate the r-f marker when it is desired to use the marker signal as an r-f signal for testing purposes. The 600-cycle modulation is also available with the output of the crystal oscillator.

1-11. Since an oscilloscope is frequently used in conjunction with an FM signal for the visual alignment of equipment, a jack is provided on the front panel to furnish for the oscilloscope a horizontal sweep signal, identical to the modulating signal of the FM oscillator.

1-12. A blanking circuit is also included to eliminate one half of each cycle of the 60-cycle, a-c modulating signal applied to the FM oscillator. It is therefore possible to establish a base line on the oscilloscope screen so that relative gain measurements can be made.

1-13. A self-contained power supply operating from a 110—120-volt, 60-cycle power source supplies all the operating potentials required by the equipment.

1-14. EQUIPMENT SUPPLIED.

1-15. The equipment, comprising one shipment of Generator, Sweep AN/URM-75, supplied under contract number NOas 52-854 and shown in figure 1-1, is tabulated in TABLE 1-1.

TABLE 1-1
EQUIPMENT SUPPLIED

Item	*Quantity*	*Description*
1	1	Generator, Sweep SG-93/URM-75
2	1	Cord CG-409/U (4'1")
3	1	Cable Assembly, Special Purpose, Electrical CX-2718/U (4'3")
4	1	Cable Assembly, Special Purpose, Electrical CX-2726/U (4'4")
5	1	Cover, Sweep Generator CW-340/URM-75

1-16. EQUIPMENT CHARACTERISTICS.

1-17. MECHANICAL.

a. Weight .....30 lbs.
b. Height .....10 in.
c. Width .....15 in.
d. Depth .....10 in.

1-18. ELECTRICAL.

a. Input Power .....115V ±10V, 60 cycles.
b. Sweep-Oscillator Frequency Ranges.
Band A.....5—50 mc.
Band B.....50—220 mc.
c. Sweep-Oscillator Output Level.
Band A.....10,000 μV.
Band B.....50,000 μV.
d. Sweep-Oscillator Frequency Deviation.
Band A.....up to 10 mc.
Band B.....up to 10% of the center frequency.
e. Marker-Oscillator Frequency Ranges.
Band A.....4—8 mc.
Band B.....8—16 mc.
Band C.....15—32 mc.
Band D.....30—60 mc.
Band E.....52—105 mc.
Band F.....96—220 mc.
f. Marker-Oscillator Output Level.
Band A.....5,000 μV.
Band B.....5,000 μV.
Band C.....5,000 μV.
Band D.....5,000 μV.
Band E.....3,000 μV.
Band F.....1,500 μV.
g. Marker-Oscillator Modulation Frequency .....600 cps.

1-19. TUBE, RECTIFIER, INDICATOR-LAMP, AND FUSE COMPLEMENT.

1-20. The tubes, crystal rectifiers, indicator lamps, and fuses employed in Generator, Sweep SG-93/URM-75 are listed in TABLE 1-2.

TABLE 1-2
TUBES, RECTIFIERS, INDICATOR LAMPS, AND FUSES

Reference Symbol	*Type*	*Function*
V1	6BQ7	Marker oscillator
V2	6BJ6	Crystal oscillator
V3	12AU7	Audio oscillator and blanking amplifier
V4	6BQ7	Modulator/a-f amplifier
V5	7Z4	Rectifier
V6	6BQ7	Sweep oscillator
V7	6BQ7	Sweep converter
V8	6BQ7	Output unit
I1	Type 51	Pilot lamp
Y2		Crystal for crystal oscillator
CR1	1N34	Detector for AM modulation
CR2	1N34	Blanking rectifier
F1	1 ampere Littlefuse	Fuse, primary, power, 1 ampere

1-21. LOCATION AND FUNCTION OF CONTROLS.

1-22. OPERATING CONTROLS.

1-23. All operating controls of Generator, Sweep SG-93/URM-75 are located on the front panel, as illustrated in figure 1-2. A listing of all operating controls together with their reference symbols and functions will be found in TABLE 1-3.

TABLE 1-3
FUNCTION OF OPERATING CONTROLS

Control Name	*Reference Symbol*	*Function*
PHASING	R16 and S4	Knob-controlled switch and potentiometer. In PWR. OFF position, disconnects primary a-c voltage from equipment. When control is rotated clockwise from PWR. OFF position, primary a-c power is applied to equipment. Further rotation varies phase of 60-cycle a-c voltage available at SCOPE jack for use as sweep-trace voltage for an external oscilloscope.
SWEEP RANGE	S5	Knob-controlled, three-position rotary switch. Selects range of frequencies over which FM sweep oscillator can operate. In OFF position, FM sweep oscillator is inoperative. In A position, FM sweep oscillator produces sweep signal in 5 to 50-mc band. In B position, FM sweep oscillator produces sweep signal in 50 to 220-mc band.
SWEEP FREQ.	L18	Knob-controlled variable inductor. Adjusts center frequency of FM sweep oscillator.
SWEEP WIDTH	R37	Knob-controlled potentiometer. Adjusts amount of sweep-signal deviation.
SWEEP LEVEL	R26	Knob-controlled potentiometer. Adjusts amplitude of sweep signal.
SELECT	S3	Knob-controlled, six-position rotary switch. Selects function of marker oscillator, crystal oscillator, and audio oscillator. In OFF position, marker oscillator, crystal oscillator, and audio oscillator are inoperative. In MKR. position, crystal oscillator and audio oscillator are inoperative, and marker oscillator is operative to produce unmodulated r-f signal, which is available at both the MKR. OUT jack and the MIXED OUTPUT jack for marker purposes or for general test and alignment purposes. In XTAL. position, marker oscillator and audio oscillator are inoperative to produce an accurate unmodulated r-f signal, which is available at each output jack for calibration of external equipment. In CAL. position, audio oscillator is inoperative, and both marker oscillator and crystal oscillator are operative to produce beat signal, which is available at the MIXED OUTPUT jack for calibration of marker oscillator. In MOD. MKR. position, crystal oscillator is inoperative, and both marker oscillator and audio oscillator are operative to produce modulated r-f signal, which is available at each output jack for general test and alignment purposes. In MOD. XTAL. position, marker oscillator is inoperative, and both crystal oscillator and audio oscillator are operative to produce an accurate modulated r-f signal, which is available at each output jack for calibration of external equipment.
MARKER RANGE	S1	Knob-controlled, six position rotary switch. In each position, switch selects range of frequencies over which marker oscillator can operate, as follows: A position, 4 to 8 mc; B position, 8 to 16 mc; C position, 15 to 32 mc; D position, 30 to 60 mc; E position, 52 to 105 mc; and F position, 96 to 220 mc.
MARKER FREQ.	C15	Knob-controlled, variable capacitor. Adjusts frequency of marker oscillator.

TABLE 1-3 (Continued)

Control Name	*Reference Symbol*	*Function*
MARKER LEVEL	R27	Knob-controlled potentiometer. Adjusts amplitude of marker signal.
OUTPUT LEVEL	S6	Knob-controlled, six-position rotary switch. Adjusts amplitude of signal to MIXED OUTPUT jack. Calibrated to increase output in steps of approximately 10 times next lower level. Panel markings for control are 1, 10, 100, 1K, 10K, and HIGH. Output impedance for all positions except HIGH is constant at 50 ohms.
BLANKING	R15 and S4	Knob-controlled switch and potentiometer. In OFF position, removes blanking voltage to SCOPE jack. When control is rotated clockwise from OFF position, applies blanking voltage to SCOPE jack for external oscilloscope. Further rotation varies amplitude of blanking voltage.
BIAS	R31	Knob-controlled potentiometer. Varies voltage to BIAS jack from 0 to −12 volts.

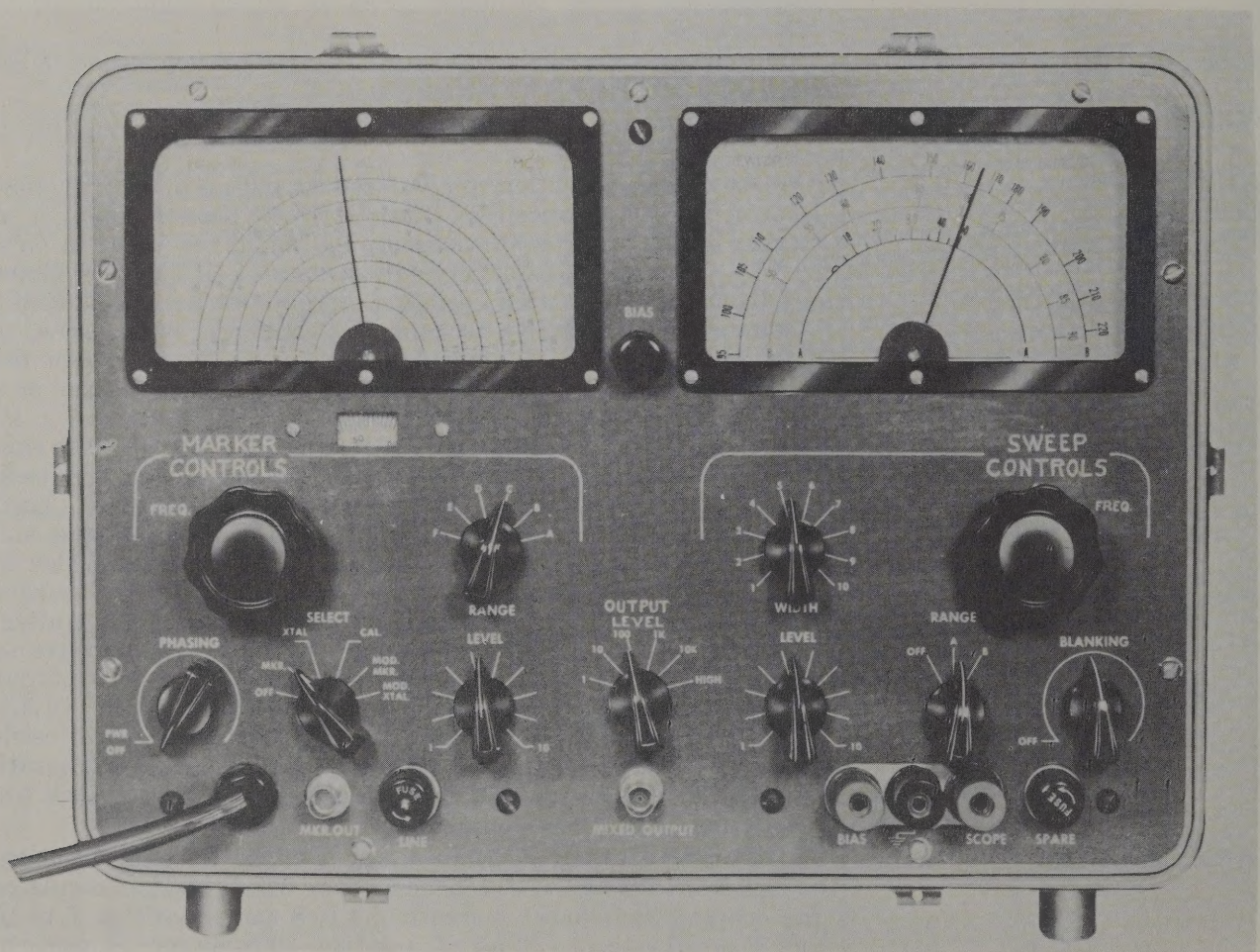

Figure 1-2. Generator, Sweep SG-93/URM-75, Front View, Showing Location of Operating Controls

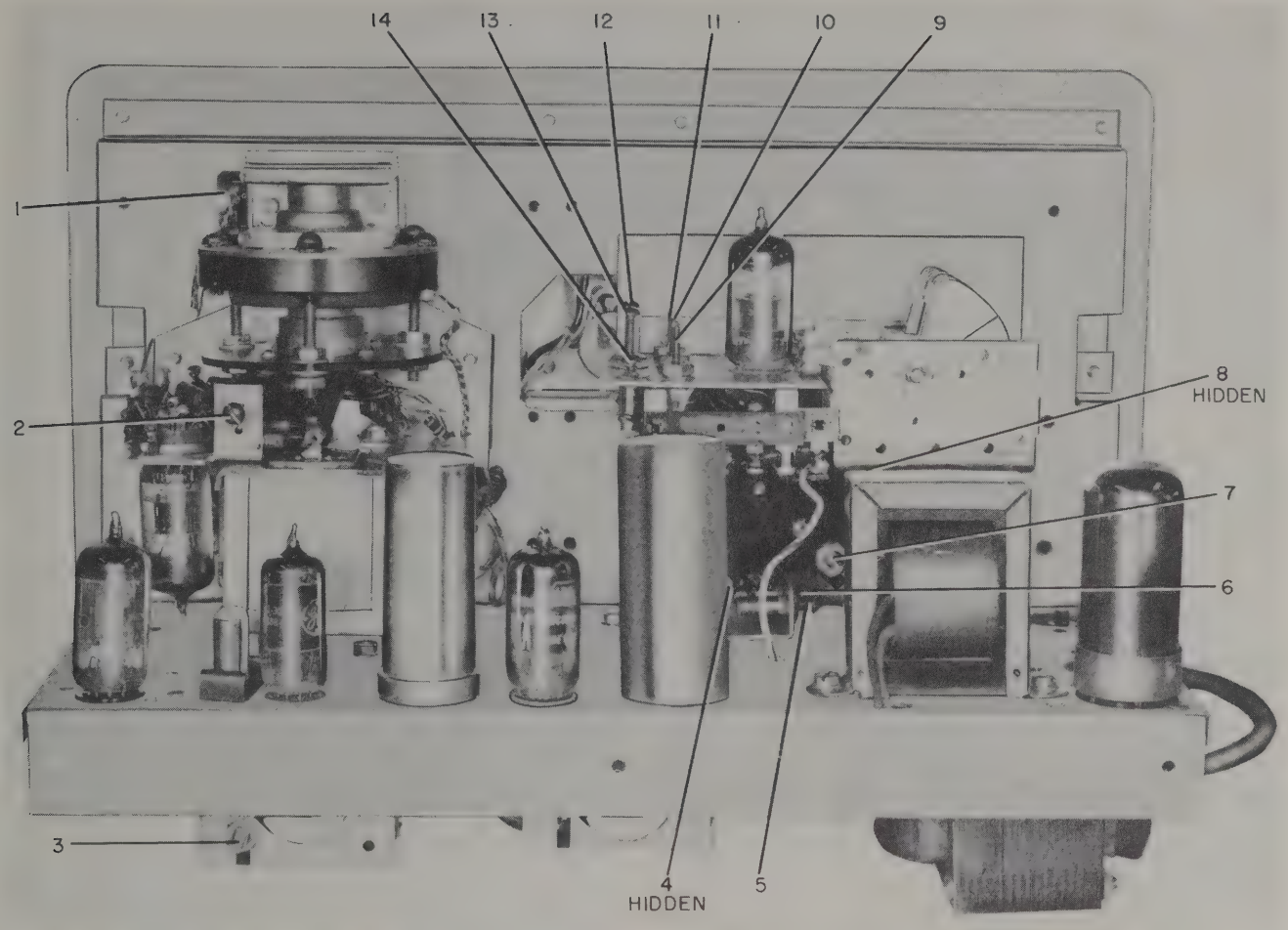

Figure 1-3. Generator, Sweep SG-93/URM-75, Rear View, Showing Location of Adjustment Controls

1-24. ADJUSTMENT CONTROLS.

1-25. The location of all adjustment controls for Generator, Sweep SG-93/URM-75 is shown in figure 1-3. TABLE 1-4 contains a list of all adjustment controls together with their reference symbols, index numbers, and functions.

TABLE 1-4
LOCATION AND FUNCTION OF ADJUSTMENT CONTROLS

Index No.	*Reference Symbol*	*Function*
1	R36	Potentiometer used to limit range of SWEEP WIDTH control.
2	C54	Variable capacitor used to align high-frequency end of sweep-oscillator band B.
3	L22	Tuning core used to adjust the frequency of the sweep converter.
4	L5	Tuning core used to align low-frequency end of marker-oscillator band D.
5	C10	Variable capacitor used to align high-frequency end of marker-oscillator band E.
6	C11	Variable capacitor used to align high-frequency end of marker-oscillator band D.
7	L6	Tuning core used to align low-frequency end of marker-oscillator band E.
8	C8	Variable capacitor used to align high-frequency end of marker-oscillator band F.
9	L7	Tuning core used to align low-frequency end of marker-oscillator band A.
10	L8	Tuning core used to align low-frequency end of marker-oscillator band B.
11	L9	Tuning core used to align low-frequency end of marker-oscillator band C.
12	C14	Variable capacitor used to align high-frequency end of marker-oscillator band C.
13	C13	Variable capacitor used to align high-frequency end of marker-oscillator band B.
14	C12	Variable capacitor used to align high-frequency end of marker-oscillator band A.

SECTION II

SPECIAL TEST EQUIPMENT AND SPECIAL TOOLS

2-1. SPECIAL TEST EQUIPMENT.

2-2. No special test equipment is furnished for Generator, Sweep AN/URM-75.

2-3. SPECIAL TOOLS.

2-4. No special tools are furnished for Generator, Sweep AN/URM-75.

SECTION III

PREPARATION FOR USE AND RESHIPMENT

3-1. UNCRATING THE EQUIPMENT.

3-2. Carefully uncrate the equipment and examine it for obvious mechanical damage. Remove the protective cover from the front panel and check all controls for correct mechanical operation. Check the contents of the packing case with the packing slip and with the list of equipment supplied as given in TABLE 1-1.

3-3. EQUIPMENT CHECK.

3-4. Remove the eleven screws that secure the equipment within its dust cover, and carefully remove the unit. Check all tubes for correct seating in their sockets. Make a general inspection of the unit for loose or broken wires.

3-5. When the visual check has been completed, replace the unit in its dust cover. Check the fuse for correct rating. The unit is now ready for the application of power and for the performance checks outlined in the Handbook of Operating Instructions for Generator, Sweep AN/URM-75, NAVAER 16-30URM75-501. Should it be desired to locate the equipment permanently, refer to figure 7-1, to determine space requirements.

3-6. PREPARATION FOR RESHIPMENT.

3-7. Remove the protective cover from the front panel, and check the contents of the cover for the correct accessory cables in accordance with TABLE 1-1. Remove the nine screws from the front panel, and withdraw the unit from its dust cover. Make a visual inspection to ensure that all tubes are securely in place. Replace the unit in the dust cover, and replace the protective cover over the front panel.

3-8. The unit is now ready for crating in accordance with applicable specifications covering overseas shipment or local shipment, as the case may be.

SECTION IV

THEORY OF OPERATION

4-1. GENERAL EQUIPMENT OPERATION.

4-2. The operation of Generator, Sweep SG-93/URM-75 may best be explained with the aid of the block diagram shown in figure 4-1. The equipment incorporates a group of oscillators which generates signals that may be combined in a number of ways for use in aligning radio equipment. The oscillators include a sweep oscillator, a marker oscillator, a crystal oscillator, and an audio oscillator. The sweep oscillator produces an r-f signal between 50 and 220 megacycles. This signal may be modulated at a 60-cycle rate to produce a frequency-modulated signal having an adjustable sweep deviation from zero to 10 megacycles. The output of the sweep oscillator may be heterodyned with the output of a fixed-frequency oscillator (the sweep converter) operating at 116.5 megacycles, to extend the range of available FM signals from 50 megacycles down to 5 megacycles. The marker oscillator generates a single-frequency signal between 4 and 220 megacycles; this signal is available separately or it may be mixed with the FM signal.

4-3. The crystal oscillator, operating on a fundamental frequency of 10 megacycles and designed to produce many harmonics, functions as a calibration oscillator. Its output may be combined with the marker or sweep (FM) signal for calibrating purposes, and is also available for the calibration of other equipment. The audio oscillator, operating at 600 cycles, provides a signal that may be used to amplitude-modulate the marker or crystal oscillator. Thus several different types of signals are produced by the equipment. The various combinations of these signals will be discussed in more detail in the following paragraphs.

4-4. With the SELECT switch (S3) in the OFF position and the SWEEP RANGE switch (S5) in the B (50—220 mc) position the sweep oscillator will operate, since B+ is applied through contacts 9 and 10 of S5A. The output signal is applied through contacts 5 and 2 of S5B to the output unit and thence through the attenuator to the MIXED OUTPUT jack (J3). The a-c modulating signal is applied from the power supply through contacts 10 and 9 of S5B. When the SWEEP RANGE switch is placed in the A (0—50 mc) position, B+ is applied through contacts 10 and 9 of S5A, to the sweep oscillator while contacts 10 and 11 complete the B+ circuit to the sweep converter. Thus these two circuits are permitted to operate. The output from the sweep oscillator is applied through contacts 5 and 6 of S5B to the sweep converter, where it is heterodyned with the 116.5-mc signal produced by the sweep converter. The FM signal is taken from the output of the sweep converter through contacts 3 and 2 of S5B and is applied to the output unit as described above.

4-5. When the SELECT switch is placed in the MKR. position, B+ is applied through contacts 8 and 7 of S3B to the marker oscillator, allowing the oscillator to function. The output from the marker oscillator is applied to the mixer (V4). The output from the mixer is fed to the output unit and is available together with the FM signal if the FM portion of the equipment is operating. The marker signal is also available at the MKR. OUT jack (J4).

4-6. When the SELECT switch is advanced to the XTAL. position, B+ is applied through contacts 8 and 11 of S3B, allowing the crystal oscillator to function, while B+ is removed from the marker oscillator. The output from the crystal oscillator is applied to the output unit (V8) and is available at the MKR. OUT jack (J4), or together with the sweep signal at the MIXED OUTPUT jack if such a combination is desired. The output signal from the crystal oscillator is also applied, through a series of capacitors not shown in figure 4-1, to the grid of the mixer (V4). However, since the grid is grounded through contacts 10 and 11 of S3A, this signal produces no effect on the signal at the output jacks.

4-7. When the SELECT switch is advanced to the CAL. position, the crystal oscillator may be used to calibrate the marker oscillator. The ground is removed from contact 10 of switch S3A, and hence from the grid of the mixer (V4). Contacts 8 and 11 of switch S3B apply B+ to the crystal oscillator, while contacts 8 and 7 apply B+ to the marker oscillator (V1). The output signals from the crystal oscillator and the marker oscillator are applied across the crystal rectifier CR1, and the beat signal produced by heterodyne action is applied to the grid of the audio frequency amplifier. The output from the audio frequency amplifier is applied to the grid of the output and is available at the MIXED OUTPUT jack (J3). The zero-beat signals, which occur every 10 megacycles, may then be observed on an oscilloscope. To avoid extraneous zero-beat signals, SWEEP

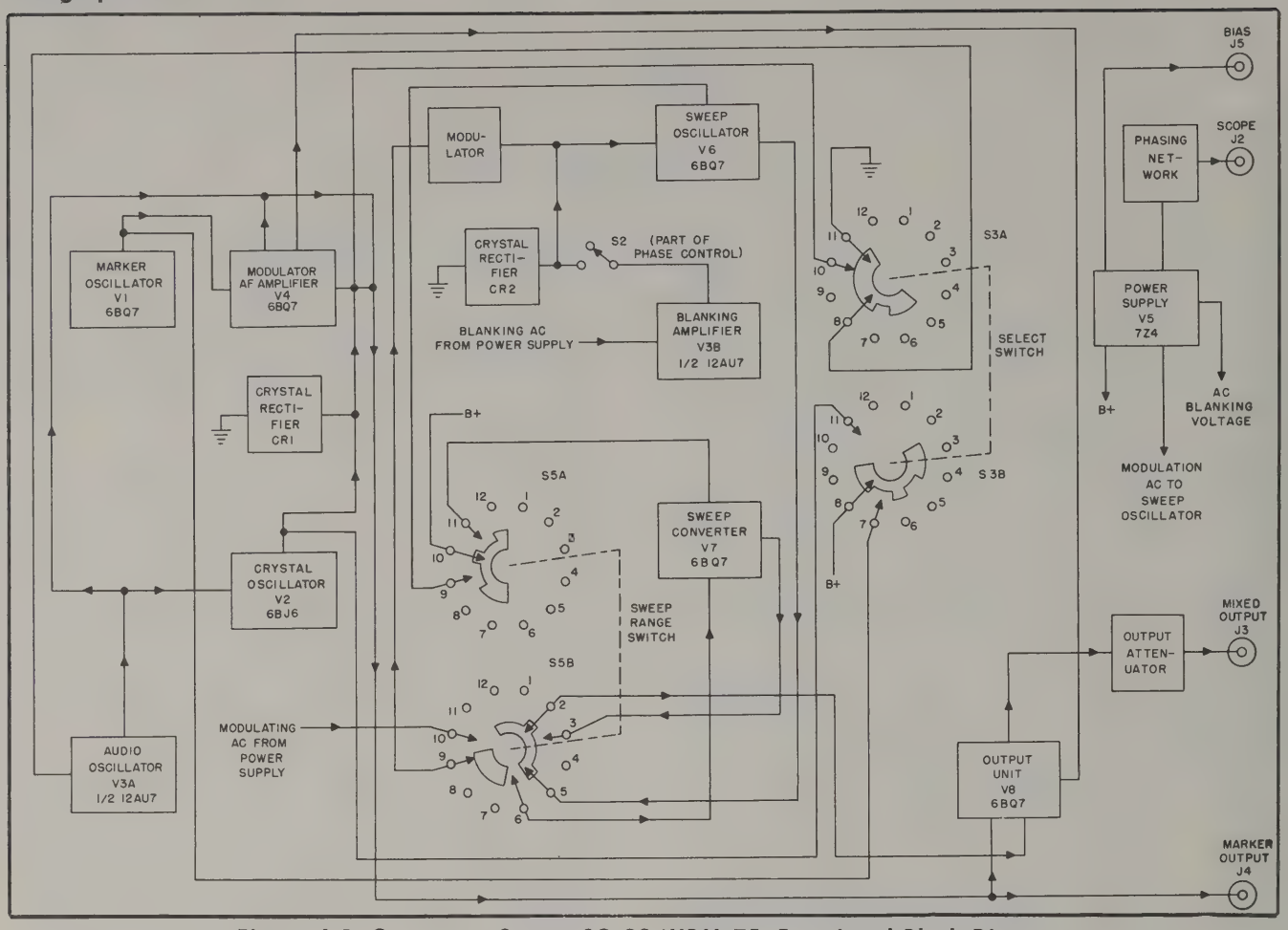

Figure 4-1. Generator, Sweep SG-93/URM-75, Functional Block Diagram

RANGE switch S5 should be placed in the OFF position.

4-8. When the SELECT switch is placed in the MOD. MKR. position, a 600-cycle audio signal is used to amplitude-modulate the marker signal. The ground is removed from the grid of the audio oscillator (V3A) by contacts 11 and 8 of S3A, while contacts 8 and 7 of S3B furnish B+ to the marker oscillator. The 600-cycle signal developed by the audio oscillator is applied to the plate of the first triode section of the modulator (V4), and the output from the marker oscillator (V1) is applied to the grid of the same section. The amplitude-modulated marker signal developed by the mixer is taken from the plate circuit and is made available at the MKR. OUT jack (J4). The modulated marker signal is also applied to the cathode of the first triode section of the output unit (V8), and is therefore available at the MIXED OUTPUT jack (J3) together with the sweep signal, if this combination is desired.

4-9. When the SELECT switch is placed in the MOD. XTAL. position, the 10-megacycle crystal-oscillator signal is modulated by the 600-cycle audio-oscillator signal. The ground is removed from the grid of the audio oscillator by switch S3A, while B+ is applied to the crystal oscillator through contacts 8 and 11 of S3B. The output of the audio oscillator is applied as modulation to the crystal oscillator. The modulated 10-megacycle signal from the crystal oscillator is available at the MKR. OUT jack (J4). The output of the crystal oscillator is also applied to the first section of the output unit (V8) and hence is available with the sweep signals, if this combination is desired.

4-10. Provisions are also included for "blanking" of the sweep oscillator. This process consists of stopping the oscillation of the sweep oscillator for a portion of each cycle of the modulating signal, so as to reduce the sweep signal to zero and establish a base line on the oscilloscope. To obtain the blanking signal, a 60-cycle, a-c signal is applied from the power supply to the blanking amplifier (V3B), and the output of the amplifier is rectified by crystal rectifier (CR2) (assuming that S2 is in the closed position). The resulting negative half cycles produced in the rectifier output

are then applied to the sweep oscillator, causing it to stop oscillation for the duration of each half cycle.

4-11. The power supply furnishes all the required d-c operating potentials. In addition, it furnishes an a-c signal through a phasing network for use as a horizontal sweep signal for an oscilloscope. This signal is available at the SCOPE output jack (J2). The power supply also provides a variable, negative, 12-volt d-c output, which is available at the BIAS jack (J5).

4-12. DETAILED CIRCUIT ANALYSIS.

4-13. SWEEP OSCILLATOR.

4-14. The function of the sweep oscillator is to generate an FM signal with a center frequency variable over the range of 50 to 220 megacycles. Frequency-modulation is accomplished by variation of the capacitance of a sweep capacitor in the oscillator tuned circuit. The sweep-oscillator circuit employs one triode section of a 6BQ7 dual triode (V6) in an ultraudion circuit. (Refer to the schematic diagram, figure 4-2.) The second triode section is used as an isolation amplifier. Plate voltage for both triode sections is applied through contacts 10, 9, and 8 of SWEEP RANGE switch S5A when the switch is in the A (0—50 mc) or B (50—220 mc) position. The plate-voltage filter, composed of L19 and C55, serves to prevent the r-f signal generated by the oscillator from being fed throughout the equipment. Resistor R43 serves as a plate-voltage-dropping resistor. Grid bias for the oscillator is supplied by the combination of C51, R41, and R42. The function of C50 is simply that of a plate voltage blocking capacitor. The tuned circuit of the oscillator consists primarily of variable inductor L18 and sweep capacitor C48A and C48B. Capacitor C54 and the interelectrode capacitance of the tube form a voltage divider which supplies the feedback voltage required to sustain oscillations. The center frequency of the oscillator is controlled by the adjustment of L18. The sweep capacitor is mechanically coupled to the modulator unit, which is essentially a permanent-magnet loudspeaker assembly. Modulation of the sweep oscillator is accomplished in the following manner.

4-15. When SWEEP RANGE switch S5B is in either the A (0—50 mc) or B (50—220 mc) position, contacts 10 and 9 furnish a 2.5-volt, 60-cycle signal from the power transformer to the coil (L16) of the modulator unit. The amplitude of this signal is variable from zero to 2.5 volts and is dependent upon the setting of the SWEEP WIDTH control (R37). Under the influence of the a-c signal, coil L16 oscillates in the magnetic field of permanent magnet E1 at a 60-cycle rate. Since the coil is mechanically coupled to sweep capacitor C48, it changes the capacitance of C48

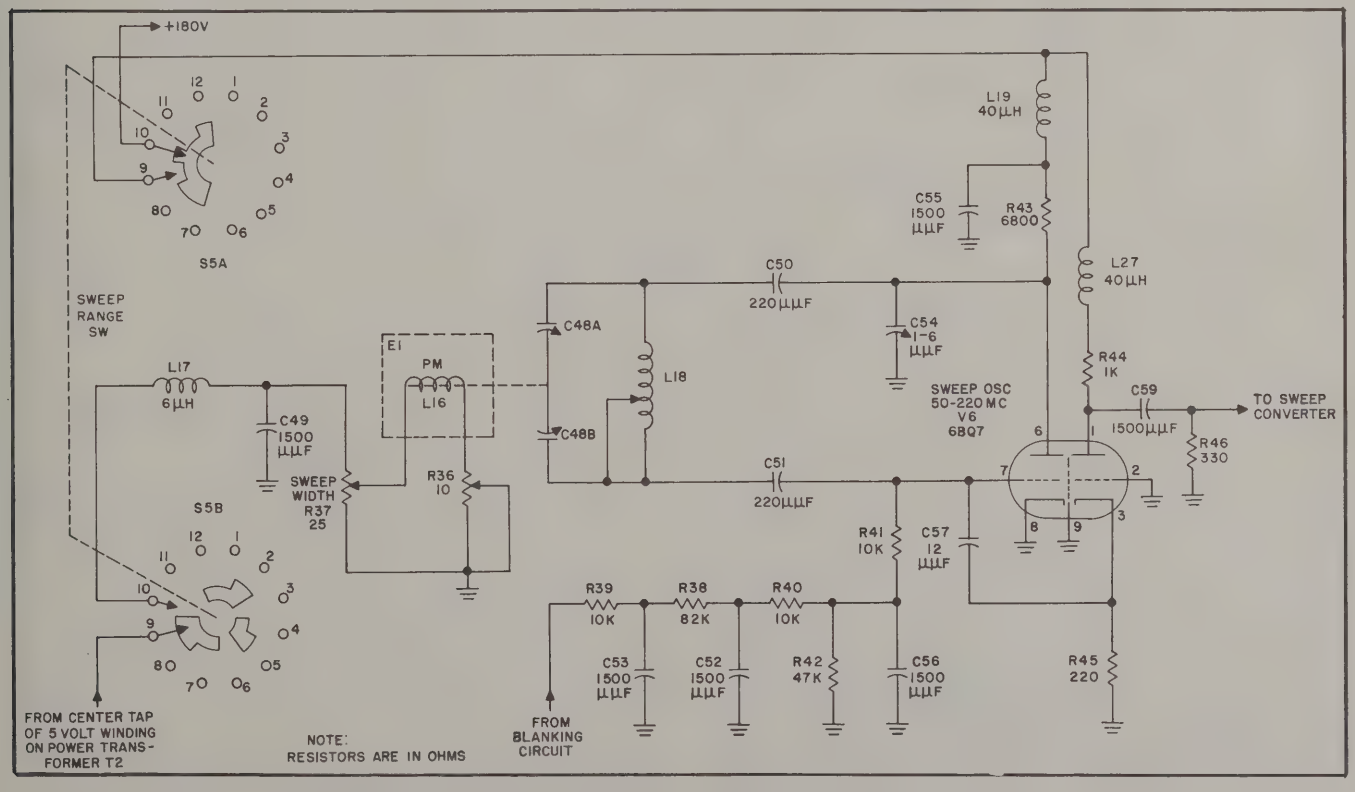

Figure 4-2. Sweep Oscillator, Simplified Schematic Diagram

at a 60-cycle rate also. The frequency of the oscillator, therefore, also varies at a 60-cycle rate. The amplitude of the frequency swing which is controlled by the SWEEP WIDTH control as outlined above, amounts to approximately 10 percent of the center frequency on band A and 12 megacycles on band B when the SWEEP WIDTH control is set for maximum.

4-16. The output of the oscillator is capacitively coupled from the grid circuit through C57 to the cathode of the second triode section of V6. The plate voltage for the amplifier section is filtered by L22, while R44 serves as the plate load resistor. Cathode bias, developed across R45, serves to establish the proper operating condition for the amplifier. The output signal, developed across R46, is applied to the mixer section of the sweep converter (V7) or to the output unit (V8) when SWEEP RANGE switch S5B is in the A (0—50 mc) or B (50—220 mc) position, respectively.

4-17. SWEEP CONVERTER.

4-18. The sweep converter extends the frequency range of the sweep oscillator from 50 megacycles down to 5 megacycles by heterodyning the FM signal from the sweep oscillator with a fixed-frequency signal, to produce a difference-frequency FM signal. The circuit employs a 6BQ7 dual triode (V7), one triode section being used in an ultraudion oscillator circuit operating at a fixed frequency of 116.5 megacycles, while the other is used as a mixer. (Refer to figure 4-3.) Plate voltage for both triode sections is obtained through the contacts of SWEEP RANGE switch S5A. When this switch is in the OFF position, resistors R48 and R47 are placed between the B+ bus and ground to stabilize the load on the power supply, R47 simulating the current drain of the sweep oscillator (V6) and R48 simulating the current drain of the sweep converter (V7). When the SWEEP RANGE switch is placed in the A (0—50 mc) position, B+ is applied to the sweep converter through contacts 10 and 11. The low-pass, pi-type filter composed of C64, L23, and C65 serves to keep the r-f energy generated by the oscillator from being fed throughout the equipment on the B+ bus. Resistor R50 functions as the plate load resistor. The capacitor-resistor

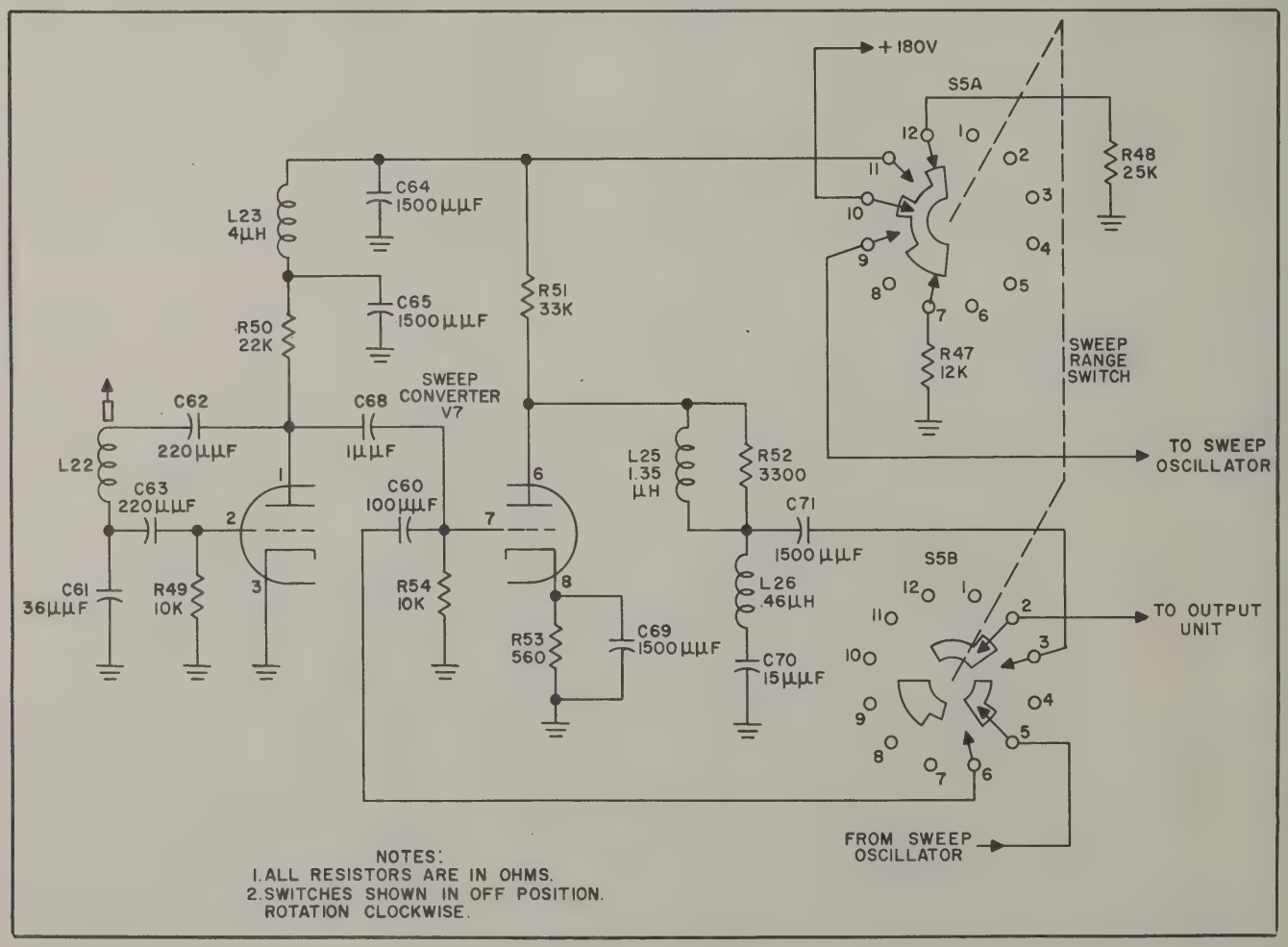

Figure 4-3. Sweep Converter, Simplified Schematic Diagram

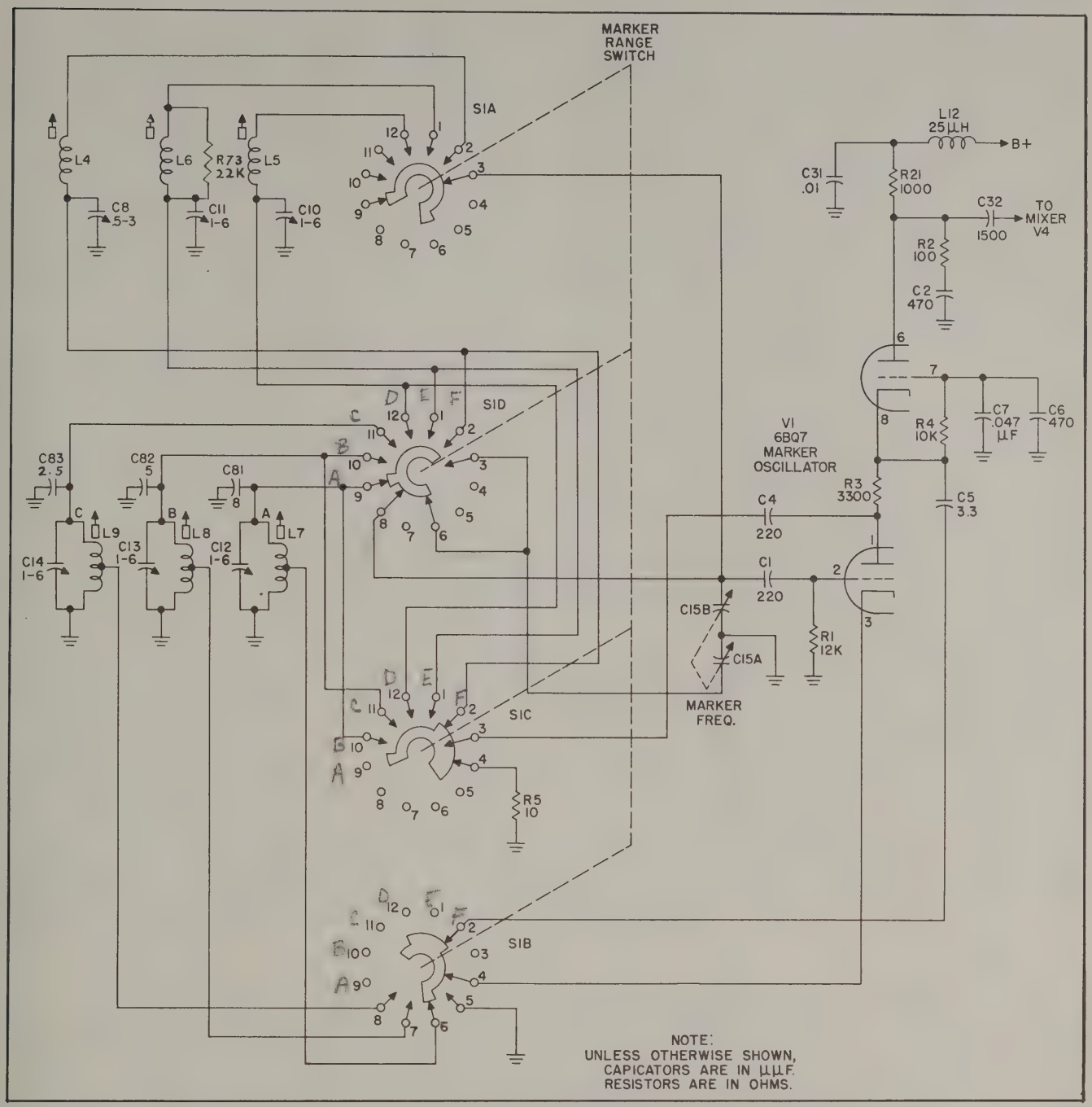

Figure 4-4. Marker Oscillator, Simplified Schematic Diagram

network consisting of R49 and C63 furnishes grid-leak bias for the oscillator. Capacitor C61 provides the correct grid drive, while L22 provides the means for adjusting the oscillator frequency to the correct value of 116.5 megacycles. The output signal from the oscillator is capacitively coupled from the plate circuit through C68 to the grid of the mixer section of the frequency converter.

4-19. The mixer circuit is essentially a voltage amplifier having two signals applied to its grid and developing a difference frequency in the plate circuit. Cathode bias is provided by the combination of R53 and C69, while R54 serves as the grid resistor. The 116.5-megacycle signal is applied to the grid through C68, and the 50-to-220-megacycle signal from the sweep oscillator, is applied through C60 and contacts 5 and 6 of SWEEP RANGE switch S5B when the switch is in the A (0—50 mc) position. Numerous beat frequencies are developed across plate load resistor R51; however, since the difference frequency is the desired signal, the filter components L25, R52, L26, and C70 are designed to minimize all other

frequencies. The output signal from the mixer is capacitively coupled from the plate circuit through C71 to the output unit (V8), through contacts 2 and 3 of SWEEP RANGE switch S5B when the switch is in the A (0—50 mc) position.

4-20. MARKER OSCILLATOR.

4-21. The function of the marker-oscillator circuit is to generate a single-frequency signal between 4 and 220 megacycles for mixing with the FM signal to provide an indication of frequency on an oscilloscope display, or for use as a separate test signal. The circuit employs a 6BQ7 dual triode (V1), one section being used as the oscillator while the other functions as an isolation amplifier. (Refer to figure 4-4.) Plate voltage is applied through contacts 8 and 7 of SELECT switch S3B (not shown in figure 4-4) when that switch is in the MKR., CAL., or MOD. MKR. position. This voltage is applied through the filter composed of L12 and C31, dropping resistor R21, tube V1B, and cathode-isolation resistor R3 to the plate of V1A. Grid bias is provided by the grid-leak combination of C1 and R1. Capacitor C4 serves as a d-c blocking capacitor.

4-22. When the MARKER RANGE switch is in position A, B, or C the oscillator is connected in Hartley-type circuit. Section S1D of the MARKER RANGE switch places inductor L7, L8, or L9 between the grid and ground and, in addition, parallels both sections of C15, and MARKER FREQ. control, and places them across the respective coils. The cathode is returned to the taps on the inductors by section S1B of the MARKER RANGE switch. Adjustment of bands A, B, and C is accomplished by the variable cores of L7, L8, and L9, and by means of the trimmer capacitors C12, C13, and C14 placed across the respective coils. The function of R5 is to load the tank circuit for band A when it is not in use, and thereby to prevent any interaction with bands B and C, which might otherwise occur because of the physical relationship of the three low-frequency tank circuits. Output from the oscillator is taken from the cathode tap on L7, L8, or L9 through C5 and the contacts of MARKER RANGE switch S1B, and is applied to the cathode of the isolation amplifier (V1B).

4-23. The isolation amplifier operates as a grounded-grid amplifier, since its cathode operates at a positive potential while the grid is at ground due to the presence of bypass capacitors C6 and C9. Resistor R4 serves as a d-c grid return to the cathode. The output of the isolation amplifier (V1B) is developed across the plate load, R2 and C2, and is capacitively coupled to the mixer by C32.

4-24. When the MARKER RANGE switch is in band D, E, or F position, the oscillator is connected in a Colpitts-type circuit. Inductor L5, L6, or L4 is placed between the grid and plate circuits of V1A for band D, E, or F operation, respectively. Both sections of MARKER FREQ. control C15 are placed in series, and the combination is shunted across the coil in use, by section S1D of the MARKER RANGE switch. The trimmer capacitors, C11, C10, and C8, together with the variable cores of the inductors provide the means of adjusting the frequency of the oscillator slightly for calibrating the dial scales. Capacitor C5 is not connected on band D, E, or F while the cathode of V1A is grounded. Since the oscillator

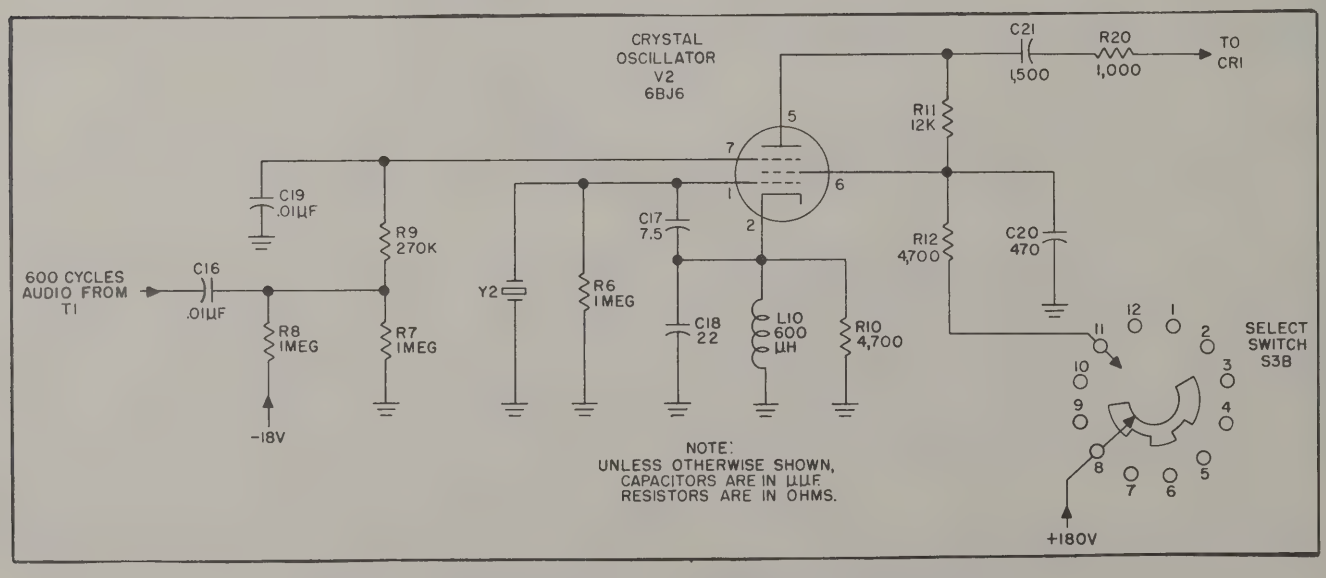

Figure 4-5. Crystal Oscillator, Simplified Schematic Diagram

plate is connected to one side of the tank circuit, it is at a point of high voltage so far as the signal is concerned. Under these conditions coupling to the isolation amplifier occurs through resistor R3. The isolation amplifier functions as described above, regardless of the band in use.

4-25. CRYSTAL OSCILLATOR.

4-26. The function of the crystal oscillator is to provide a 10-megacycle signal, rich in harmonics, for use in calibrating the marker oscillator. The circuit is of conventional design, employing a 6BJ6 pentode (V2) and a 10-megacycle crystal. (Refer to figure 4-5.) The cathode, control grid, and screen grid of the pentode effectively form a triode which produces oscillations at the crystal frequency. Plate and screen grid voltage is applied through dropping resistors R11 and R12, capacitor C20 being used to place the screen grid at r-f ground potential. Capacitors C17 and C18 form a voltage divider to provide the correct grid drive, while L10 is used to maintain the cathode above r-f ground while providing a d-c cathode circuit to ground. Resistor R6 furnishes the correct bias for the oscillator. Resistor R10 provides sufficient damping to prevent the parallel combination of L10 and C18 from generating parasitic oscillations.

4-27. The suppressor grid affords a convenient method of introducing the 600-cycle audio signal when a modulated crystal signal is desired. Coupling from the audio oscillator is provided by capacitor C16. A voltage-divider network composed of R8, R7, and R9 supplies the correct negative bias for the suppressor grid.

4-28. The r-f signal produced by the oscillator is electron-coupled to the plate circuit of V27 and is developed across plate resistor R11. The output signal of V2 is capacitively coupled from the plate circuit by means of C21 and is applied to the modulator/A-F amplifier circuit (V4).

4-29. AUDIO OSCILLATOR.

4-30. The function of the audio oscillator circuit is to produce a 600-cycle audio signal, for use in modulating the marker and crystal oscillators. The circuit employs one triode section (V3A) of a 12AU7 dual triode in a modified ultraudion circuit. (Refer to figure 4-6.) The tapped winding of transformer T1 and capacitor C23 form the tank circuit, which is designed to oscillate at 600 cycles. The resistor-capacitor combination, R13 and C22, provides grid-leak bias, while R14 furnishes protective cathode bias when the oscillator circuit is not functioning. The feedback voltage

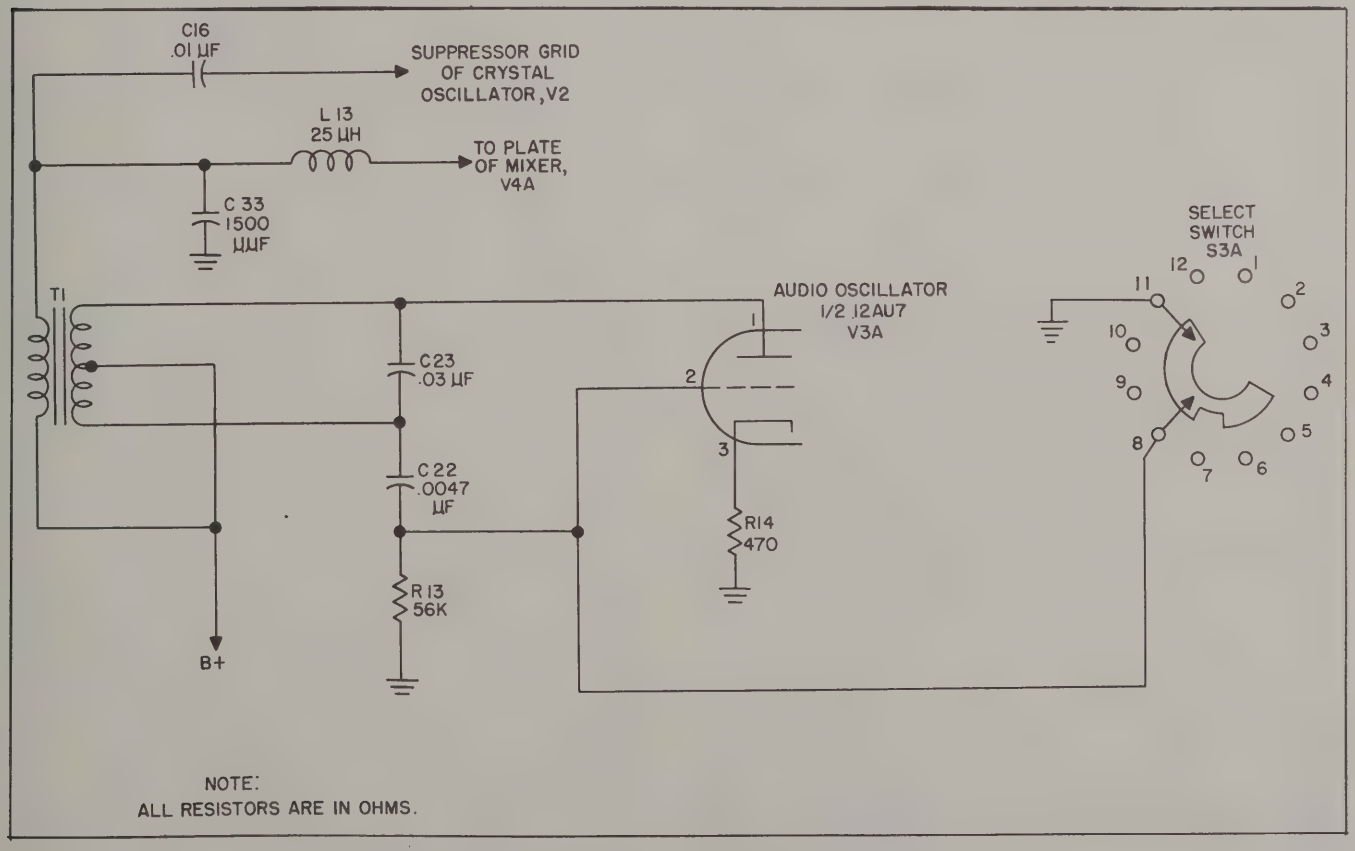

Figure 4-6. Audio Oscillator, Simplified Schematic Diagram

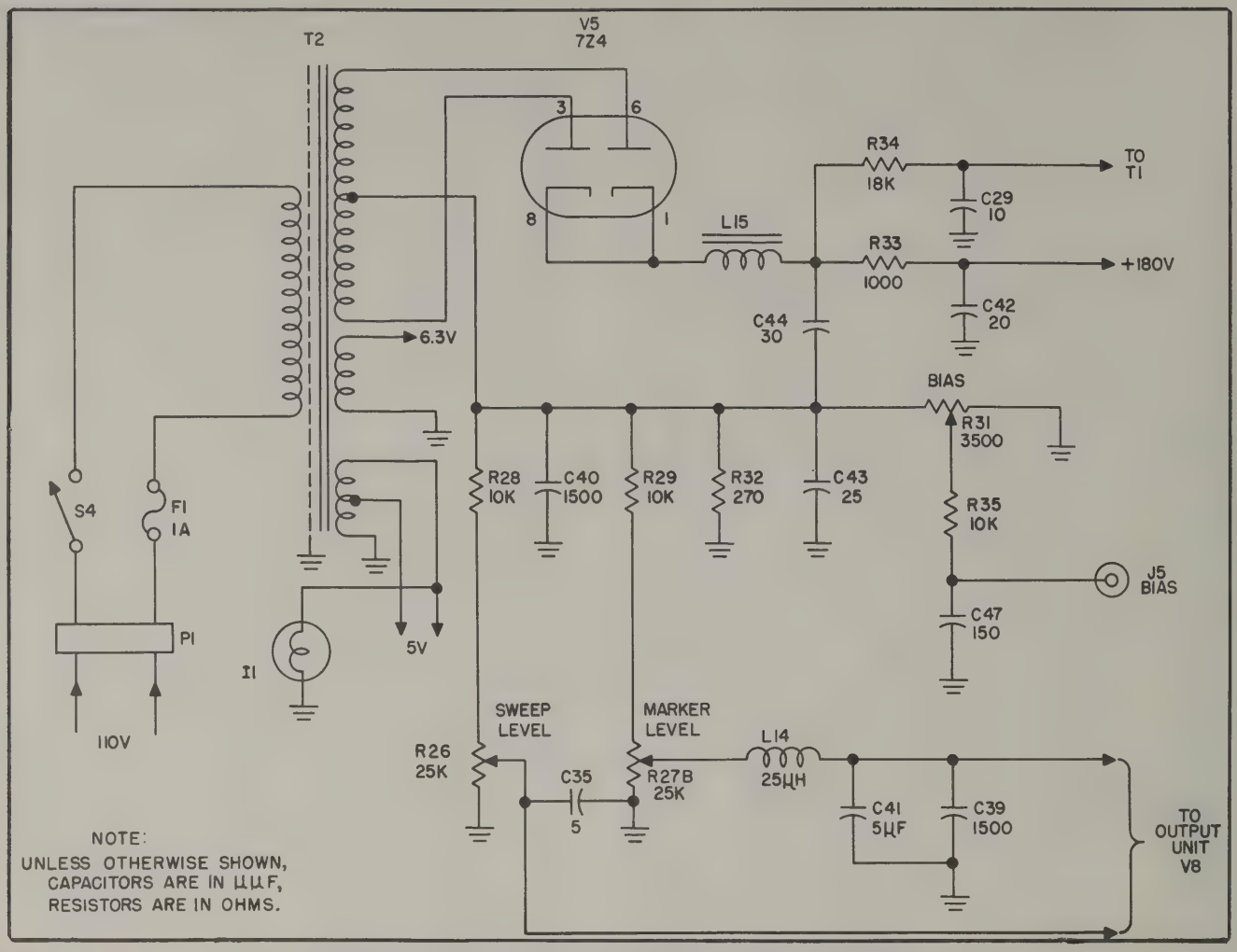

Figure 4-7. Power Supply, Simplified Schematic Diagram

is developed across that portion of the transformer winding connected between B+ and the grid.

4-31. When the oscillator is functioning, a voltage is induced in the secondary winding of T1. This signal is capacitively coupled to the crystal oscillator by means of C16. Since the plate voltage for one triode section of mixer V4A is furnished through the secondary winding of T1, the audio signal will modulate the plate of V4A. Since the grid of V3A is grounded through SELECT switch, S3A, the circuit will not function except when the switch is in the MOD. MKR. or MOD. XTAL. position.

4-32. POWER SUPPLY.

4-33. The function of the power supply is to provide the voltages necessary for the operation of the other circuits in the equipment. (Refer to figure 4-7.) The 110-volt, 60-cycle input power is applied through P1 to the primary of power transformer T2. Application of the primary power is controlled by switch S4, which is mechanically connected to, and operated by, the PHASING control. Fuse F1 protects the equipment from overloads. Power transformer T2 contains three secondary windings: a high-voltage winding which delivers 300 volts ac between the center tap and either side, and two low-voltage windings. One low-voltage winding develops 6.3 volts to heat all tube filaments, while the other develops 5 volts and is center-tapped. The 2.5 volts between one side of the 5-volt winding and the center tap is used to drive the modulating capacitor of the sweep oscillator.

4-34. The center-tapped high-voltage winding supplies power to a full-wave rectifier (V5). The output of the rectifier, 230 volts, is applied to filter choke L15. Capacitors C44 and C42 and resistor R33 provide additional filtering and deliver +180 volts to the equipment. A second output is taken from the power supply through R34 for use as plate voltage for V4A.

4-35. Several negative voltages are developed

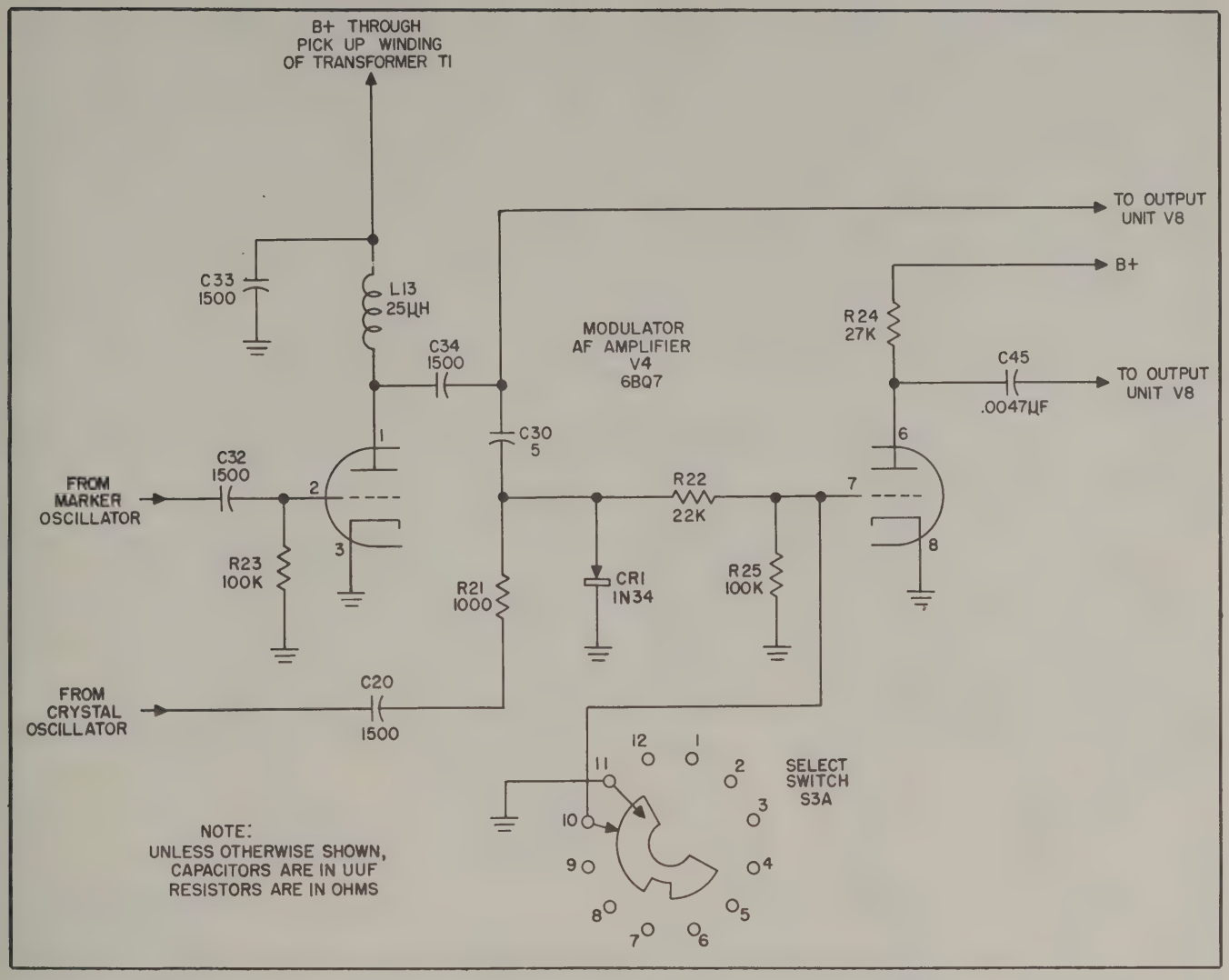

Figure 4-8. Modulator/A-F Amplifier Circuit, Simplified Schematic Diagram

across resistor networks placed between the negative side of the power supply and ground. Resistors R28 and R26 provide a negative voltage, variable from −8 to zero volts, at the arm of potentiometer R26 (the SWEEP LEVEL control) for application to the grid of the output unit (V8). Capacitor C35 serves to stabilize the voltage at the level selected. Resistors R29 and R27B develop a negative voltage variable from −8 to zero volts, at the arm of potentiometer R27B (the MARKER LEVEL control). This negative voltage is applied through the filter network composed of L14, C41, and C39 to the grid of one section of the output unit (V8). Resistor R31 provides a negative voltage variable between −12 and zero volts. This voltage is filtered by R35 and C47, and is available at the BIAS jack on the front panel, for use in the alignment of equipment requiring such a voltage. Resistor R32 allows a relatively large bleeder current to flow, thus stabilizing the voltage applied to the other voltage dividers. Capacitor C43 provides low-frequency filtering, while capacitor C40 serves as a high-frequency bypass capacitor.

4-36. MODULATOR/A-F AMPLIFIER.

4-37. The function of the modulator circuit is to modulate the marker or crystal-oscillator signal by the 600-cycle audio-oscillator signal. The audio frequency amplifier amplifies the beat note produced by heterodyning the marker and crystal oscillator signals across CR1. The circuit employs a 6BQ7 dual triode (V4). (Refer to figure 4-8.)

4-38. When the SELECT switch is in the MKR. position, the marker oscillator functions, and its output is applied through capacitor C32 to the grid of V4A. The amplified output of V4A is capacitively coupled from the plate circuit to the MKR. OUT jack (J4). (Refer to figure 4-9.) The

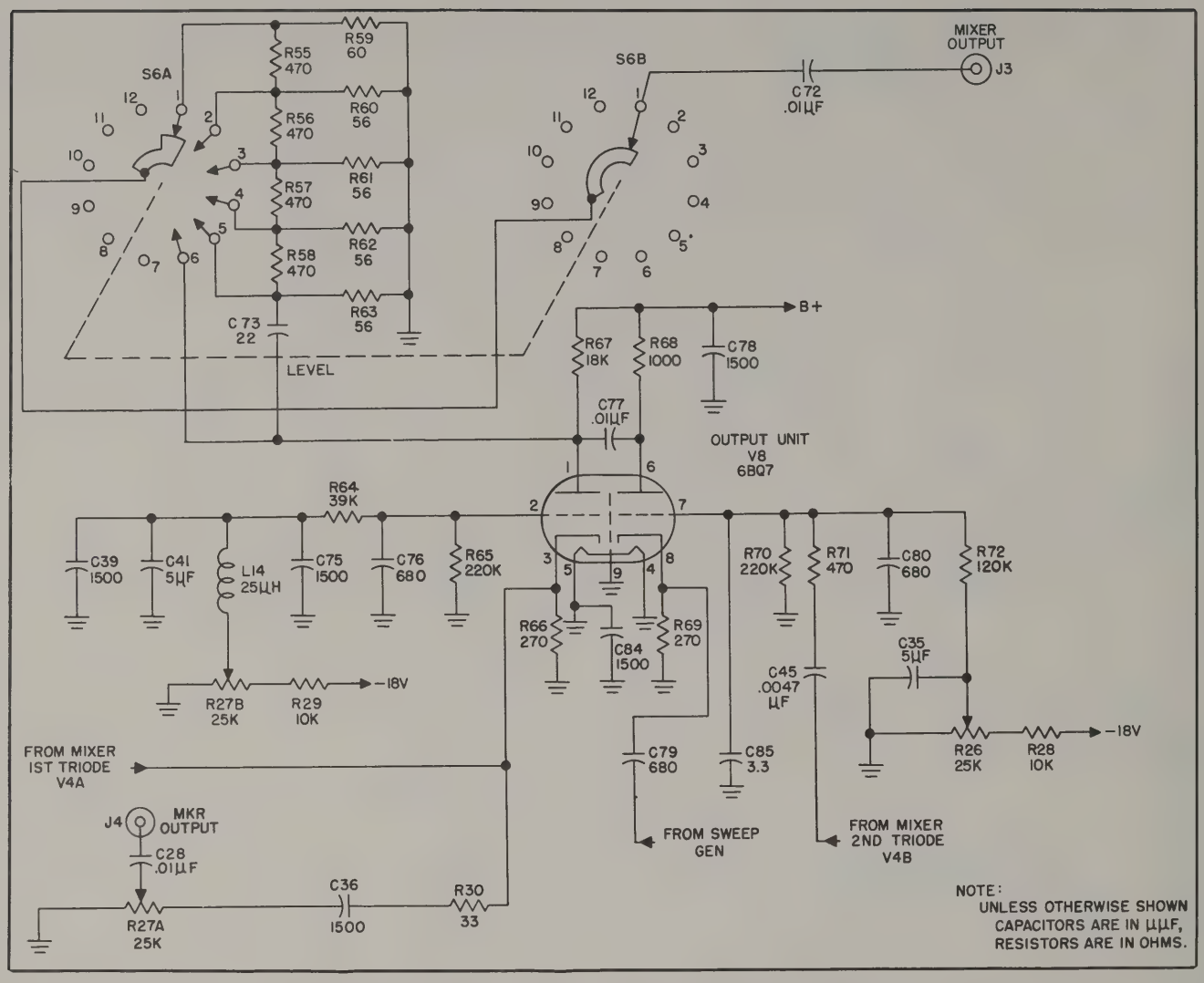

Figure 4-9. Output Unit, Simplified Schematic Diagram

output signal from V4A is also applied to the output unit (V8). When the SELECT switch is in the MOD. MKR. position, the 600-cycle audio oscillator functions and applies its output to the plate of triode V4A, because this triode receives plate voltage through a winding of audio-oscillator transformer T1. Since the marker signal is also applied to the grid at this switch position, the audio signal appears as modulation on the marker signal. The modulated marker signal is applied to the MKR. OUT jack (J4) and to the output unit (V8).

4-39. When the SELECT switch is in CAL. position, the marker signal applied to V4A is taken from the plate circuit and applied through capacitors C34 and C30, in series, to crystal rectifier CR1. The output from the crystal oscillator is also applied to CR1 through capacitor C20 and resistor R21. The two signals are heterodyned across a nonlinear impedance (CR1) to produce a difference signal, which is applied through R22 to the grid of V4B. Since the ground has been removed from the grid of V4B by the action of SELECT switch S3A, the signals are amplified. The amplified signal at the plate of V4B is capacitively coupled to the output unit (V8) through C45.

4-40. OUTPUT UNIT.

4-41. The function of the output-unit circuit is to combine the various marker signals with the output of the sweep oscillator or sweep converter. The circuit employs both triode sections of a 6BQ7 dual triode (V8). (Refer to figure 4-9.)

4-42. Plate voltage for both triode sections of V8 is supplied directly from the B+ bus through resistors R67 and R68, respectively. Grid bias for the first triode section of V8 is obtained from a voltage divider composed of R29 and R27B (the latter resistor being part of the MARKER

LEVEL control) which is connected between the −18-volt bias output of the power supply and ground. Two filter networks composed of L14, C39, and C41 and R64, C75 and C76 ensure that the grid voltage level selected will remain constant. Resistor R65 serves as the grid return for the first triode section. The grid bias level for the second triode section is obtained from the voltage divider composed of R28 and R26, the SWEEP LEVEL control, and is applied through the filter composed of R72, C35, and C80. Resistor R70 serves as the grid return for the second triode section of V8. Both triode sections contain 270-ohm cathode resistors (R66 and R69).

4-43. The FM signal from either the sweep generator or the sweep converter, depending upon the position of the SWEEP RANGE switch, is applied to the cathode of the second triode section of V8. The amplified FM signal is developed across plate load resistor R68 and is applied to the attenuator circuit through capacitor C77. The attenuator reduces the applied signal in approximate multiples of 10. The output from the attenuator is capacitively coupled through C72 to the MIXED OUTPUT jack (J3).

4-44. When the SELECT switch is in the MKR. or MOD. MKR. position, the output of the mixer (V4A) is applied to the cathode of V8A. The amplified output at the plate is combined with the FM signal, and the combination is applied through the attenuator to the MIXED OUTPUT jack (J3). When the SELECT switch is in the CAL. position, the output from the second triode section of the mixer (V4B) is applied through capacitor C45 and isolation resistor R71 to the grid of V8B. The combined marker, crystal, and FM signals at the plate of V8B are capacitively coupled through C77 to the attenuator, and from the attenuator the signals are applied to the MIXED OUTPUT jack (J3), as described above.

4-45. BLANKING AND PHASING CIRCUIT.

4-46. The function of the blanking and phasing circuit is to provide a blanking voltage to stop the oscillation of the sweep oscillator, and also to provide a 60-cycle voltage for application as a horizontal-sweep voltage to an oscilloscope. The circuit employs one triode section (V3B) of a 12AU7 dual triode. (Refer to figure 4-10.)

4-47. An 11.3-volt, 60-cycle signal, taken from opposite ends of the 5-volt winding and the 6.3-volt winding of power transformer is applied to a bridge-type phasing network composed of C25, R15, C24, and R16. The a-c signal at the output of the bridge is applied to the grid of V3B, which produces an amplified version of the input

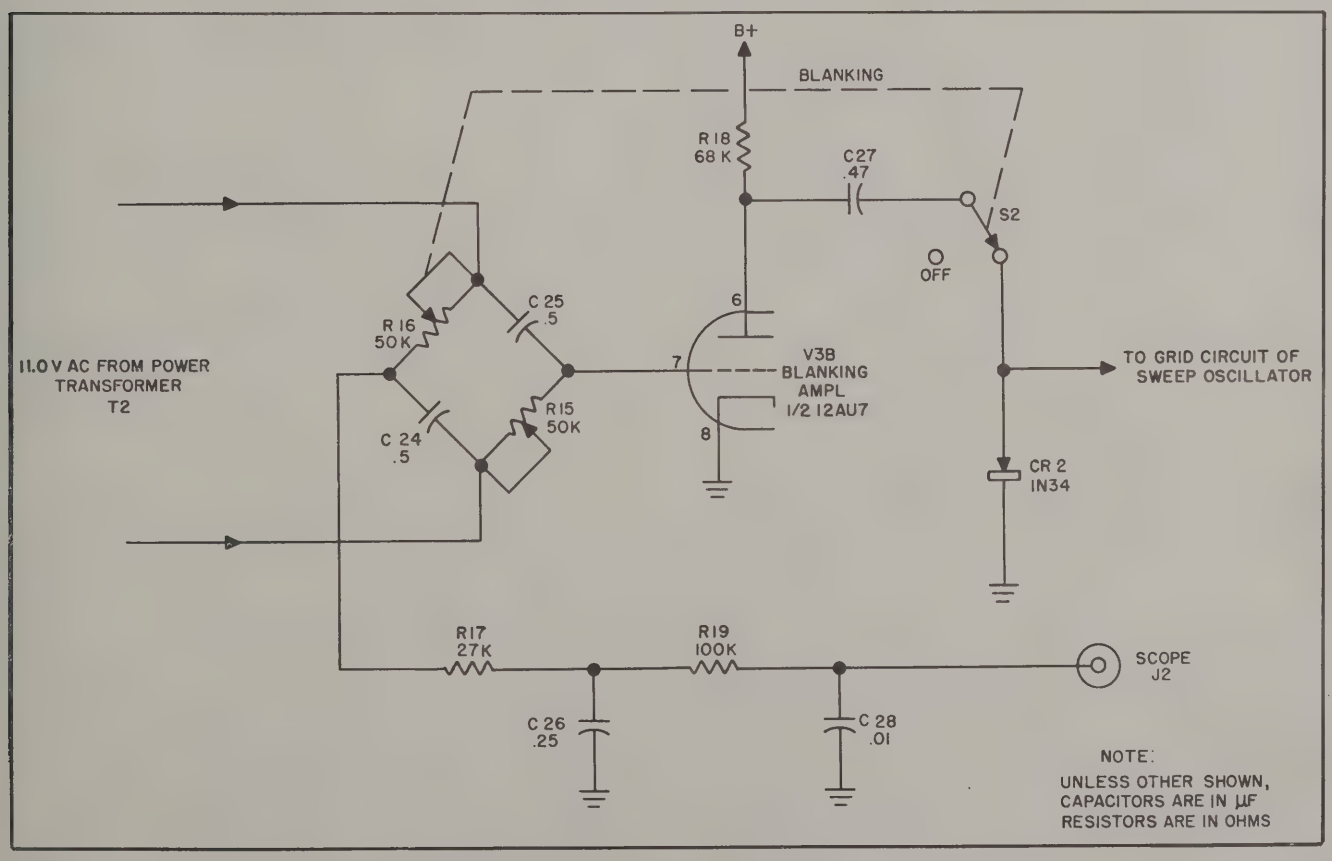

Figure 4-10. Blanking and Phasing Circuit, Simplified Schematic Diagram

signal at the plate. When the BLANKING control is operated to the ON position, the crystal rectifier is placed across the tube. During each positive half cycle of the a-c signal, conduction occurs through CR1, causing the positive half cycle to be clipped. During each negative half cycle conduction through the crystal stops, and a large negative signal is developed at the plate of V3B. This negative signal, applied through a capacitor C27 and a subsequent filter to the grid of the sweep oscillator (V6B), causes the oscillator to stop oscillating. When this occurs, during one half of each cycle of the oscillator modulating signal, the FM output from the equipment remains at zero, and thereby produces a reference zero line on the oscilloscope screen.

4-48. The a-c voltage at the junction of C24 and R16, on the other side of the bridge, is applied through the filter composed of C26, R19, and C28 to the SCOPE jack (J2), for application to an oscilloscope as a horizontal sweep signal. By varying the settings of the PHASE control (R16) and the BLANKING control (R15), the phase relationship of the blanking signal and the horizontal sweep signal may be adjusted to produce a response curve with a zero reference line in correct relationship to the curve.

4-49. CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL CX-2726/U.

4-50. This cable assembly is referred to as a "detector box". A wiring diagram of the cable is shown in figure 7-10. This cable functions to convert a modulated radio-frequency input signal into an audio output signal. This cable assembly increases the utility of Generator, Sweep SG-93/URM-75.

4-51. The method of using Cable Assembly, Special Purpose, Electrical CX-2726/U is described in the various test procedures given in Sections V and VI of this handbook.

4-52. A receptacle with a plug-in terminating resistor is provided, so that the detector box may be terminated in the characteristic impedance of the output attenuator, when necessary.

SECTION V

ORGANIZATIONAL AND SQUADRON MAINTENANCE

5-1. INTRODUCTION.

5-2. This section contains instructions for the maintenance of Generator, Sweep AN/URM-75 by Organizational Maintenance activities. The information contained in this section is based on the assumption that the maintenance personnel are familiar with the physical layout of the equipment, its operating characteristics and limitations, and that they are reasonably familiar with the circuit theory of operation.

5-3. The maintenance of the equipment is built around a policy of making periodic inspections to prevent failure and thereby ensure continued operation, of using performance checks to ascertain whether or not the equipment is operating correctly, and of following a systematic trouble-shooting procedure to locate faulty circuits. This section also includes the necessary information for making minor repairs and adjustments. For more detailed maintenance information refer to Section VI of this handbook.

5-4. PERIODIC INSPECTIONS.

5-5. In order to anticipate trouble in the equipment and forestall its occurrence, an inspection schedule should be followed whereby all aspects, mechanical and electrical, of the equipment will be checked to locate and remove potential sources of trouble. The following schedule, based on both operational time and calendar time, is intended to accomplish this end.

5-6. MONTHLY OR 100-HOUR INSPECTION.

5-7. A visual inspection of the equipment should be made to determine whether any physical damage has occurred. Inspect the test cables and power cord for damaged insulation or loose connectors. Check all controls for proper mechanical operation.

5-8. Insert the power cord in a service outlet and advance the PHASING control clockwise to apply power to the equipment. Connect the test cable to the MIXED OUTPUT jack. Connect the detector-box input to the test cable from the MIXED OUTPUT, and the detector box output to the vertical input terminals of an oscilloscope. Connect the SCOPE jack to the horizontal input terminals of the oscilloscope with a test cable. Apply power to the oscilloscope, and after a warm-up period of at least five minutes perform the checks outlined below.

a. Place the SELECT switch in the OFF position, the SWEEP RANGE switch in the A (5—50 mc) position, and the OUTPUT LEVEL control in the HIGH position.

b. Place the BLANKING control in the "on" position by rotating the control clockwise from its extreme counterclockwise position.

c. Adjust the BLANKING control, PHASING control, and vertical gain control of the oscilloscope to obtain a pattern of two horizontal lines.

d. Vary the setting of the SWEEP LEVEL control. The vertical distance, on the oscilloscope screen, between the two horizontal lines should change, increasing as the control is turned clockwise and decreasing as the control is turned counterclockwise.

e. Vary the OUTPUT LEVEL control from the HIGH position downward. The two lines on the screen should again approach each other.

f. Place the SELECT switch in the MOD. MKR. position, and the SWEEP RANGE switch in the OFF position. An approximate 10 to 1 Lissajous pattern should be present on the oscilloscope screen.

g. Place the SELECT switch in the MOD. XTAL. position; the pattern described in step f, above, should again be seen.

5-9. SEMIANNUAL OR 500-HOUR INSPECTION.

5-10. In addition to the inspection and checking procedures outlined in paragraphs 5-4 through 5-8, above, the following procedure should be performed every six months or after 500 hours of operation.

5-11. Remove the unit from its dust cover. Inspect all wiring for loose connections. Check all capacitors and resistors for visual indications of trouble such as burned or blistered paint. Check all screws and nuts for tightness. Examine all tubes and tube sockets to ensure that the tubes are seated properly. Check all metal parts for corrosion. If any rust or corrosion is found, scrape the metal clean and touch up the paint. Remove the cover from the detector box and check the internal wiring.

5-12. When the visual inspection has been made, insert the power cord in a service outlet and turn the PHASING control clockwise, to apply power to the equipment. Allow a five-minute warm-up period and then perform the tests outlined in paragraph 5-17, minimum performance standards.

TABLE 5-1
SUMMARY OF INSPECTION SCHEDULE

Check	*Procedure*	*Action*	*Interval*
1	Visually inspect unit for obvious physical damage.	Repair or replace damaged part.	100 hours
2	Check controls for proper mechanical operation.	Repair or replace damaged control.	100 hours
3	Check output of sweep oscillator as per paragraph 5-8.	Correct trouble if any is found.	100 hours
4	Inspect internal wiring.	Resolder loose connections.	500 hours
5	Inspect electrical components for obvious overloading.	Replace overloaded component. Locate and correct cause of overload.	500 hours
6	Check minimum performance standards given in paragraph 5-17.	If minimum standards are not met, trouble-shoot equipment to restore performance.	500 hours

5-13. FIELD LUBRICATION PROCEDURE.

5-14. For information concerning the lubrication of Generator, Sweep AN/URM-75, refer to Section VI of this handbook.

CAUTION

The friction-drive mechanism used between the front-panel control knob and the drive gears may slip if a lubricant is present on the mechanism.

5-15. TEST EQUIPMENT.

5-16. The proper service and maintenance of Generator, Sweep AN/URM-75 requires the use of several pieces of test equipment. These items are listed in TABLE 5-2.

TABLE 5-2
TEST EQUIPMENT

Item	*Description*	*Alternates*
1.	Multimeter (20,000 ohms per volt) TS-352/U	Weston 790 Simpson 260
2.	Oscilloscope TS-239/UP	Dumont Model 304A
3.	Tube Tester, Signal Corps Type I-177A	Hickok 540 Hickok 547
4.	Electronic Multimeter ME-6A/U	

5-17. MINIMUM PERFORMANCE STANDARDS (FIELD).

5-18. The minimum performance standards listed in TABLE 5-3 below are intended to indicate when each functional group of circuits is operating at a level which will produce satisfactory results. Power should be applied, to both the Sweep Generator being checked and the test equipment being used to perform the checks, for a period of at least five minutes, to ensure that all circuits have reached stable operating conditions.

5-19. CONTROL SETTINGS.

5-20. Before starting the checks outlined below, set the controls of Generator, Sweep SG-93/URM-75 in the following positions:

Control	*Setting*
MARKER RANGE	1
MARKER LEVEL	10
SELECT switch	OFF
BIAS	Fully counterclockwise
OUTPUT LEVEL	HIGH
BLANKING	ON
SWEEP LEVEL	10
SWEEP WIDTH	1
SWEEP RANGE	OFF

Note

For convenience, the rectangular box attached to one end of Cable Assembly, Special Purpose, Electrical CX-2726/U is called the "detector box" in the following procedures. The input of the detector box is the coaxial connector attached to the box; the output terminals are the alligator clips at the other end of the cable.

TABLE 5-3
MINIMUM PERFORMANCE STANDARDS

Function Checked	*Step*	*Control Settings*	*Procedure*	*Normal Indication*	*Possible Cause of Abnormal Indication*
Blanking and phasing	1	Place SWEEP RANGE switch at A.	Connect the detector box input to the MIXED OUTPUT jack, the vertical input of the oscilloscope to the detector box output, and horizontal input to SCOPE terminal. Provide a ground between Sweep Generator and oscilloscope. Adjust vertical and horizontal gain controls of oscilloscope for a usable pattern size.	Pattern on oscilloscope screen should resemble a square or rectangle having faint vertical sides, a straight bottom edge, and a top edge which may be slightly irregular.	Blanking and phasing circuits. Power transformer, FM generator, output unit, or attenuator circuit.
Sweep generator	2	Same as step 1. Place SWEEP FREQ. control at 10 mc.	Connect detector-box input to MIXED OUTPUT jack, and measure output from detector box using ME-6A/U Vacuum-Tube Voltmeter.	The output should be at least .01 volt.	Detector box. Sweep oscillator. Sweep converter.

TABLE 5-3 (Continued)

Function Checked	*Step*	*Control Settings*	*Procedure*	*Normal Indication*	*Possible Cause of Abnormal Indication*
Sweep generator (Cont)	3	Same as step 1. Place SWEEP FREQ. control at 50 mc.	Same as step 2.	Same as step 2.	Same as step 2.
	4	Place SWEEP RANGE switch in position B, and SWEEP FREQ. control at 100 mc.	Same as step 2.	The output should be at least .05 volt.	Detector box. Sweep oscillator.
	5	With SWEEP RANGE switch in position B adjust SWEEP FREQ. control to 200 mc.	Same as step 2.	Same as step 4.	Same as step 4.
Marker generator	6	Place SWEEP RANGE switch in position A, SWEEP FREQ. control at 5 mc, and SELECT switch at MKR. Place MARKER RANGE control to A.	Connect the vertical input of oscilloscope to MIXED OUPUT jack. Slowly swing MARKER FREQ. control through 5-mc calibration point on band A scale.	A beat pattern should be seen on oscilloscope as marker oscillator is tuned through 5 mc.	Circuit components of marker oscillator band A.
	7	Place SWEEP RANGE switch in position A, and SWEEP FREQ. control at 10 mc. Place MARKER RANGE switch at B.	With oscilloscope connected as in step 6, slowly swing MARKER FREQ. control through 10-mc calibration point on band B scale.	A beat pattern should be seen on oscilloscope as marker oscillator is tuned through 10 mc.	Circuit components of marker oscillator band B.
	8	Place SWEEP RANGE switch in position A, and SWEEP FREQ. control at 20 mc. Place MARKER RANGE switch at C.	With oscilloscope connected as in step 6, slowly swing MARKER FREQ. control through 20-mc calibration point on band C scale.	A beat pattern should be seen on oscilloscope as marker oscillator is tuned through 20 mc.	Circuit components of marker oscillator band C.
	9	Place SWEEP RANGE switch in position A, and SWEEP FREQ. control at 40 mc. Place MARKER RANGE switch at D.	With oscilloscope connected as in step 6, slowly swing MARKER FREQ. control through 40-mc calibration point on band D scale.	A beat pattern should be seen on the oscilloscope as marker oscillator is tuned through 40 mc.	Circuit components of marker oscillator band D.

TABLE 5-3 (Continued)

Function Checked	*Step*	*Control Settings*	*Procedure*	*Normal Indication*	*Possible Cause of Abnormal Indication*
Marker generator (Cont)	10	Place SWEEP RANGE switch in position B; and SWEEP FREQ. control at 75 mc. Place MARKER RANGE switch at E.	With oscilloscope connected as in step 6, slowly swing MARKER FREQ. control through 75-mc calibration point on band E scale.	A beat pattern should be seen on oscilloscope screen as marker oscillator is tuned through 75 mc.	Circuit components of marker oscillator band E.
	11	Place SWEEP RANGE switch in position B, and SWEEP FREQ. control at 140 mc. Place MARKER RANGE switch at F.	With oscilloscope connected as in step 6, slowly swing MARKER FREQ. control through 140-mc calibration point on band F scale.	A beat pattern should be seen on oscilloscope as marker oscillator is tuned through 140 mc.	Circuit components of marker oscillator band F.
Audio oscillator	12	Place SELECT switch in MOD. MKR. position.	Connect detector-box input to MKR. OUT jack and connect output of detector box to vertical input of oscilloscope.	A 600-cycle audio signal should be seen on oscilloscope.	Audio-oscillator circuit.
Crystal oscillator	13	Place SELECT switch in CAL. position, and MARKER RANGE switch in position A.	Connect vertical input of oscilloscope to MKR. OUT jack.	A beat pattern is seen at 10-mc intervals as MARKER FREQ. control is tuned across its range.	Crystal-oscillator circuit.
Attenuator circuit	14	Place SELECT switch in MOD. MKR. position. Place SWEEP RANGE switch in OFF position.	Connect detector-box input to MIXED OUTPUT jack, and connect output of detector box to vertical input of oscilloscope.	The 600-cycle audio signal should decrease in amplitude as OUTPUT LEVEL control is rotated from HIGH position to position 1.	Attenuator circuit.

5-21. ADJUSTMENTS.

5-22. All adjustments of Generator, Sweep SG-93/URM-75 should be made by Field and FASRon maintenance personnel as described in Section VI of this handbook.

5-23. SYSTEM TROUBLE SHOOTING.

5-24. The trouble-shooting procedure outlined in TABLE 5-4 is designed to localize the trouble to a particular functional group of circuits or components. When this has been accomplished, the trouble-shooting charts of Section VI should be followed to locate the faulty circuit component.

TABLE 5-4
FUNCTIONAL TROUBLE-SHOOTING CHART

Step	*Test Point*	*Test-Equipment Control Settings*	*Generator Control Settings*	*Normal Indication*	*Possible Cause of Abnormal Indication*
1	① BIAS jack	Control settings of Test Set TS-352/U: Set FUNCTION switch to 20,000 Ω/V DC. Connect test leads to COMM. pin jack and 50 V pin jack.	Set SWEEP RANGE switch to OFF, MARKER RANGE switch to OFF, and SELECT switch to OFF. Advance PWR switch to "on", and connect a-c cord to power source. Turn BIAS control fully clockwise.	A reading of approximately −12 V dc should be obtained between BIAS and ground terminals.	Check components of power supply. Refer to Section VI Trouble-Shooting Chart.
2	② White lead on T1	Control settings of Test Set TS-352/U: Set FUNCTION switch to AC. Connect leads to COMM. pin jack and 50 V pin jack.	Set SWEEP RANGE switch to OFF, and SELECT switch to MOD. MKR.	With a .01-μf capacitor in series with the positive test lead, a reading of 20 volts should be obtained.	Check components of audio oscillator. Refer to Section VI Trouble-Shooting Chart.
3	③ Pin 8 of V8	Use .05-volt scale of Test Set ME-6A/U.	Set SWEEP RANGE switch to A, and SELECT switch to OFF. Connect detector-box input to test point, and measure voltage at output of detector box.	The reading should be at least .01 volt.	Check components of sweep generator. Refer to Section VI Trouble-Shooting Chart.
4	④ MKR. OUT jack	Same as step 3.	Set SWEEP RANGE switch to OFF, and SELECT switch to MOD. MKR. Connect detector-box input to test point, and measure output.	The reading should be at least .02 volt.	Check components of marker-oscillator circuit. Refer to Section VI Trouble-Shooting Chart.
5	⑤ Pin 5 of V2	Use .5-volt scale of ME-6A/U.	Set SWEEP RANGE switch to OFF, and SELECT switch to MOD. XTAL. Connect detector-box input to test point, and measure output of detector box.	The reading should be at least .2 volt.	Check components of crystal oscillator. Refer to Section VI Trouble-Shooting Chart.

TABLE 5-4 (Continued)

Step	*Test Point*	*Test-Equipment Control Settings*	*Generator Control Settings*	*Normal Indication*	*Possible Cause of Abnormal Indication*
6	⑥ Pin 6 of V3	Control settings of Test Set TS-352/U: Set FUNCTION switch to AC. Connect test leads to COMM. pin jack and 250 V pin jack.	Place BLANKING switch in "on" position.	With a .01-μf blocking capacitor in series with test lead, a reading of 50 volts should be obtained.	Check components of blanking circuit. Refer to Section VI Trouble-Shooting Chart.

5-25. REMOVAL AND REPLACEMENT OF PARTS.

5-26. REMOVAL AND REPLACEMENT OF PILOT LAMP.

5-27. In order to replace the pilot lamp, it is necessary to remove the front panel. This may be accomplished as follows:

a. Remove the eleven screws which secure the equipment in its dust cover.

b. Remove all control knobs from their shafts.

c. Remove the five screws which secure the front panel, and remove the panel.

d. The pilot lamp is now exposed and may be replaced with one from spares.

e. Replace front panel and secure it in place with the five screws removed in step c, above.

f. Replace all control knobs removed in step b, above.

g. Replace unit in its dust cover and secure it in place with the nine screws removed in step a, above.

5-28. REMOVAL AND REPLACEMENT OF TUBES.

5-29. In order to remove the tubes in Generator, Sweep SG-93/URM-75, use the following procedure. (See figure 5-1 for location of tubes.)

a. Remove the eleven screws securing the equipment in the dust cover and withdraw the unit.

b. To gain access to V6, remove the 14 screws securing the shield for the sweep-oscillator assembly.

c. To gain access to V1, remove the 16 screws securing the shield for the marker-oscillator assembly.

d. The remainder of the tubes are accessible on withdrawing the unit from its dust cover.

5-30. REMOVAL AND REPLACEMENT OF CRYSTAL Y2.

5-31. Removal of crystal Y2 is accomplished by unplugging the crystal from its socket after the unit is removed from its dust cover.

5-32. REMOVAL AND REPLACEMENT OF CRYSTAL RECTIFIERS CR1 AND CR2.

5-33. The crystal rectifiers, which are soldered in place, may be removed by first removing the unit from its dust cover and unsoldering the rectifiers. Care should be exercised not to overheat the crystals while installing new ones.

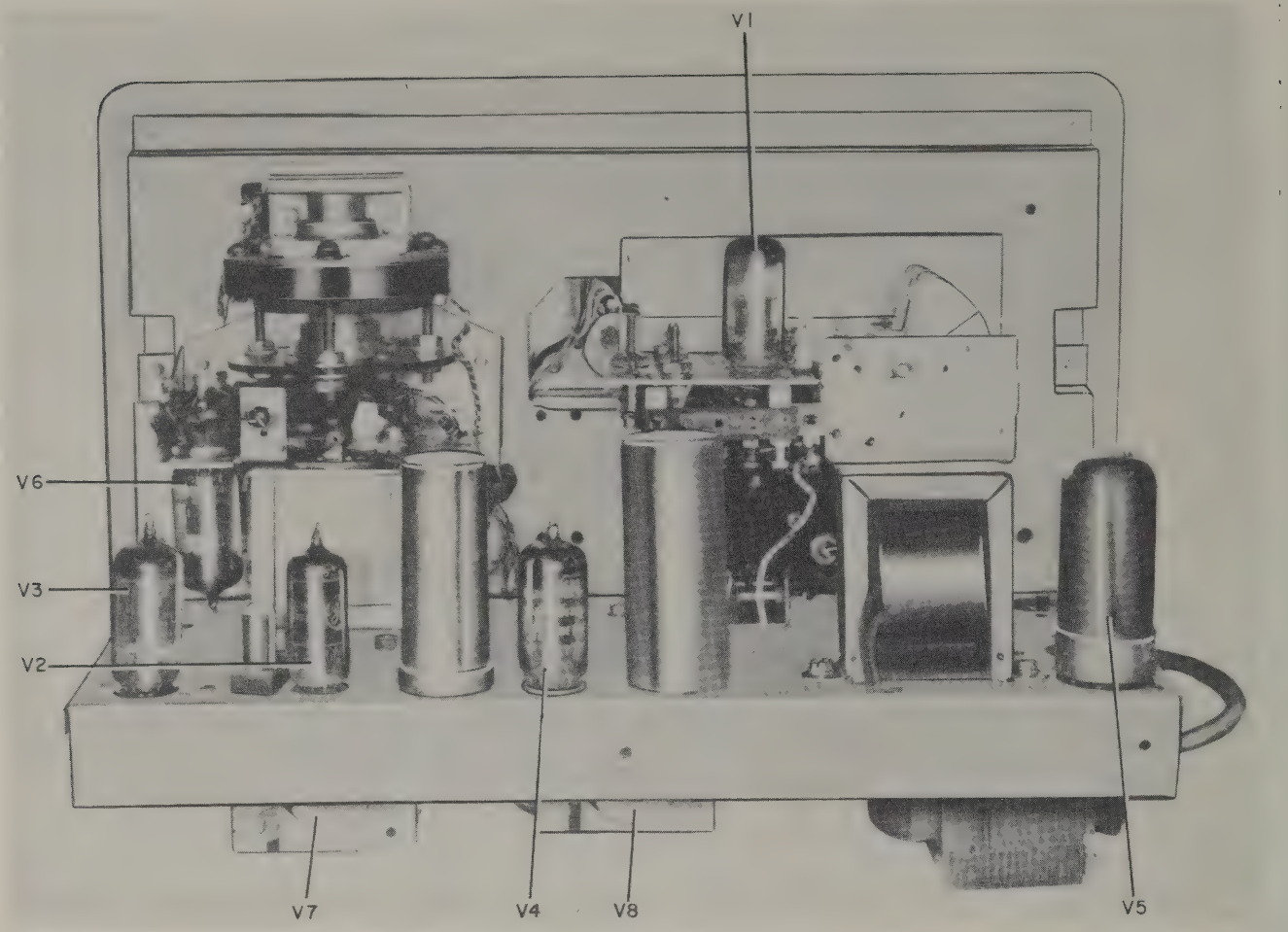

Figure 5-1. Generator, Sweep SG-93/URM-75, Rear View, Showing Location of Tubes

SECTION VI

FIELD AND FASRON MAINTENANCE

6-1. MAINTENANCE AND INSPECTION SCHEDULE.

6-2. In addition to the schedule given in paragraph 5-4, the following schedule should be followed to ensure continued operation of the equipment.

TABLE 6-1
MAINTENANCE AND INSPECTION SCHEDULE

Item Inspected	*Inspection*	*Inspection Interval*
Modulator Unit	Remove unit from its dust cover and apply power to equipment. With SWEEP RANGE switch in either A or B position and SWEEP WIDTH control advanced to its full clockwise position, observe action of modulating capacitor. Its movement should be free and unimpeded.	500 hours

6-3. OVERHAUL SCHEDULE.

6-4. The schedule of overhaul for the equipment will be found in the Handbook of Overhaul Instructions for Generator, Sweep AN/URM-75, NAVAER 16-30URM75-503.

6-5. MINIMUM PERFORMANCE STANDARDS (FASRON).

6-6. The tests outlined in TABLE 6-2 indicate the minimum performance specifications which a repaired unit must meet before it will be considered acceptable for return to service.

6-7. Before starting the tests, remove the unit from its dust cover, apply power, and allow the equipment to warm up for a period of at least five minutes. Set all controls to the initial positions indicated below:

Control	*Position*
MARKER RANGE	1
MARKER LEVEL	10
SELECT switch	OFF
BIAS	Fully counterclockwise
OUTPUT LEVEL	HIGH
BLANKING	"On"
SWEEP LEVEL	10
SWEEP WIDTH	1
SWEEP RANGE	OFF

Note

For convenience, the rectangular box attached to one end of Cable Assembly, Special Purpose, Electrical CX-2726/U is called the "detector box" in the following procedures. The input of the detector box is the coaxial connector attached to the box; the output terminals are the alligator clips at the other end of the cable.

TABLE 6-2
MINIMUM PERFORMANCE STANDARDS FOR REPAIRED UNIT

Functional Section Checked	*Step*	*Control Settings*	*Procedure*	*Normal Indication*
Blanking	1	Initial positions	Using oscilloscope TS-239A/UP, observe signal at grid (pin 7) of sweep oscillator V6, and measure its amplitude.	A signal consisting of negative half cycles of a 60-cycle sine wave and having an amplitude of 20 volts should be seen on oscilloscope screen.

TABLE 6-2 (Continued)

Functional Section Checked	*Step*	*Control Settings*	*Procedure*	*Normal Indication*
Phasing	2	Initial positions	Using 60-cycle internal sweep of oscilloscope, observe output of SCOPE jack (J2) by applying signal to vertical input of TS-239A/UP, while varying the PHASING control.	A one-to-one Lissajous pattern which shifts in phase as the PHASE control is varied should be seen on the oscilloscope screen.
Sweep generator	3	Set SWEEP RANGE switch to position B. Connect detector-box input to MIXED OUTPUT jack.	Using Test Set ME-6A/U, measure voltage at detector-box output while varying the SWEEP FREQ. control across its range.	A reading of at least .05 volt should be obtained over entire range of SWEEP FREQ. control.
	4	Set SWEEP RANGE switch to position A.	Same as step 3.	A reading of at least .01 volt should be obtained over the entire range of the SWEEP FREQ. control.

6-8. ALIGNMENT AND ADJUSTMENTS.

6-9. ADJUSTMENT OF SWEEP OSCILLATOR.

6-10. The sweep-oscillator circuit contains a single adjustment which may be used to bring the output frequency into agreement with the dial reading. The procedure for setting the adjustment is as follows:

a. Remove the eleven screws which secure equipment to dust cover, and remove equipment from dust cover.

b. Connect the MIXED OUTPUT jack to the vertical input of oscilloscope.

c. Apply power to Sweep Generator and oscilloscope, and allow a warm-up period of at least five minutes before making any adjustments.

d. Set SELECT switch in CAL position, OUTPUT LEVEL control to HIGH, MARKER LEVEL control to 10, SWEEP RANGE switch to OFF, BLANKING control to OFF, SWEEP WIDTH control to 1, and MARKER FREQ. control to obtain a beat pattern at 220 mc.

e. Set the SELECT switch to MKR., SWEEP RANGE switch to B, and the SWEEP FREQ. control at the 220 mc point on the B scale.

f. Adjust trimmer capacitor C54 for a beat pattern.

6-11. ADJUSTMENT OF SWEEP CONVERTER.

6-12. The sweep converter operates at a fixed frequency of 116.5 mc. Should it become necessary to adjust the frequency of this oscillator, use the following procedure which is based on the assumption that the sweep oscillator has been correctly adjusted as described in paragraph 4-9.

a. Remove the eleven screws from front panel which secure equipment in its dust cover, and withdraw unit.

b. Connect detector-box input to MIXED OUTPUT jack, and connect detector-box output to vertical input of oscilloscope. Connect horizontal input of oscilloscope to SCOPE jack. Disconnect the terminating resistor from the side of the detector box.

c. Apply power to Sweep Generator and oscilloscope, and allow a warm-up period of at least five minutes before making any adjustments.

d. Set SELECT switch to XTAL position, MARKER LEVEL control to 10, OUTPUT LEVEL control to HIGH, SWEEP LEVEL control to 10, SWEEP RANGE switch to A, BLANKING control to "on", SWEEP WIDTH control to 1, and SWEEP FREQ. control to 20.

e. Adjust BLANKING and PHASING controls of Sweep Generator and gain controls of oscilloscope to produce a rectangular pattern on oscilloscope screen.

f. Adjust core of L22 for zero beat. This condition is indicated by the appearance of a beat pattern across the upper trace on the oscilloscope screen.

6-13. ADJUSTMENT OF MARKER OSCILLATOR.

6-14. When a repair has been made to the marker-oscillator circuit, the marker oscillator should be adjusted in the following manner, to ensure that the frequency of the signal generated by the oscillator agrees with the dial calibration.

a. Remove the nine screws which secure equipment to dust cover, and remove equipment from dust cover.

b. Connect MIXED OUTPUT jack to vertical input of oscilloscope.

c. Apply power to equipment, and allow a warm-up period of at least five minutes before making any adjustments.

d. Set controls as follows: MARKER RANGE switch to D, SELECT switch to CAL., and MARKER FREQ. control to 30 mc.

e. Adjust core of L5 for zero-beat pattern on oscilloscope screen.

f. Adjust MARKER FREQ. control to 60 mc., and adjust trimmer capacitor C11 for zero-beat pattern on oscilloscope screen.

g. Set MARKER RANGE switch to E, and adjust MARKER FREQ. control to 60 mc.

h. Adjust core of L6 for zero-beat pattern on oscilloscope screen.

i. Adjust MARKER FREQ. control to 100-mc position on range E scale, and adjust trimmer capacitor C10 for zero-beat pattern on oscilloscope screen.

j. Set MARKER RANGE switch to position F, and adjust MARKER FREQ. control to 100-mc position on range F scale.

k. Adjust the position of L4 with respect to the copper plate immediately above L4 for zero-beat pattern on oscilloscope screen.

l. Adjust MARKER FREQ. control to 220-mc position on range F scale. Adjust trimmer capacitor C8 for zero-beat pattern on oscilloscope screen.

m. Set MARKER RANGE switch to position A, and adjust MARKER FREQ. control to 5-mc position on range A scale.

n. Adjust core of L7 for zero-beat pattern on oscilloscope screen.

o. Adjust MARKER FREQ. control to 7.5-mc position on range A scale.

p. Adjust trimmer capacitor C12 to produce a zero-beat pattern on oscilloscope screen.

q. Set MARKER RANGE switch to position B, and adjust MARKER FREQ. control to 10-mc point on range B scale.

r. Adjust core of L8 for zero-beat pattern on oscilloscope screen.

s. Adjust MARKER FREQ. control to 15-mc position on range B scale.

t. Adjust trimmer capacitor C13 to produce zero-beat pattern on oscilloscope screen.

u. Set MARKER RANGE switch to position C, and adjust MARKER FREQ. control to the 15 mc-point on range C scale. The 15-mc point is the first scale division.

v. Adjust core of L9 for zero-beat pattern on oscilloscope screen.

w. Adjust MARKER FREQ. control to 30-mc position on range C scale.

x. Adjust trimmer capacitor C13 to produce zero-beat pattern on oscilloscope screen.

6-15. ADJUSTMENT OF RANGE OF SWEEP WIDTH CONTROL.

6-16. If repairs are made to the modulating unit for the sweep oscillator, the procedure below should be employed to ensure that the frequency swing of the sweep oscillator is adequate when the SWEEP WIDTH control is adjusted to maximum. The procedure is based on the assumption that the marker oscillator has been accurately calibrated.

a. Remove the nine screws which secure equipment to dust cover and remove equipment from dust cover.

b. Connect detector-box input to MIXED OUTPUT jack, connect output of detector box to vertical input of oscilloscope, and connect SCOPE jack to horizontal input of oscilloscope.

c. Allow equipment to warm up for a period of at least five minutes before making any adjustments.

d. Set controls to following positions: SELECT switch to MKR., MARKER RANGE switch to F, SWEEP RANGE control to B, BLANKING control to "on", SWEEP WIDTH control to 10, and SWEEP FREQ. control to 150-mc point on range B scale.

e. Adjust PHASING and BLANKING controls to produce a rectangular pattern on oscilloscope screen.

f. Adjust MARKER FREQ. control to 142.5 mc.

g. Adjust R6 to position marker signal at left-hand edge of upper trace on oscilloscope screen.

6-17. CIRCUIT TROUBLE SHOOTING.

6-18. When a trouble has been isolated to a functional circuit by means of the System Trouble-Shooting Procedure in Section V, the circuit trouble-shooting procedure outlined in TABLE 6-3, below, should be employed to locate the faulty part. For aid in locating the trouble, refer to figures 6-1 and 6-2 of this section and to figures 7-2 through 7-13 of Section VIII.

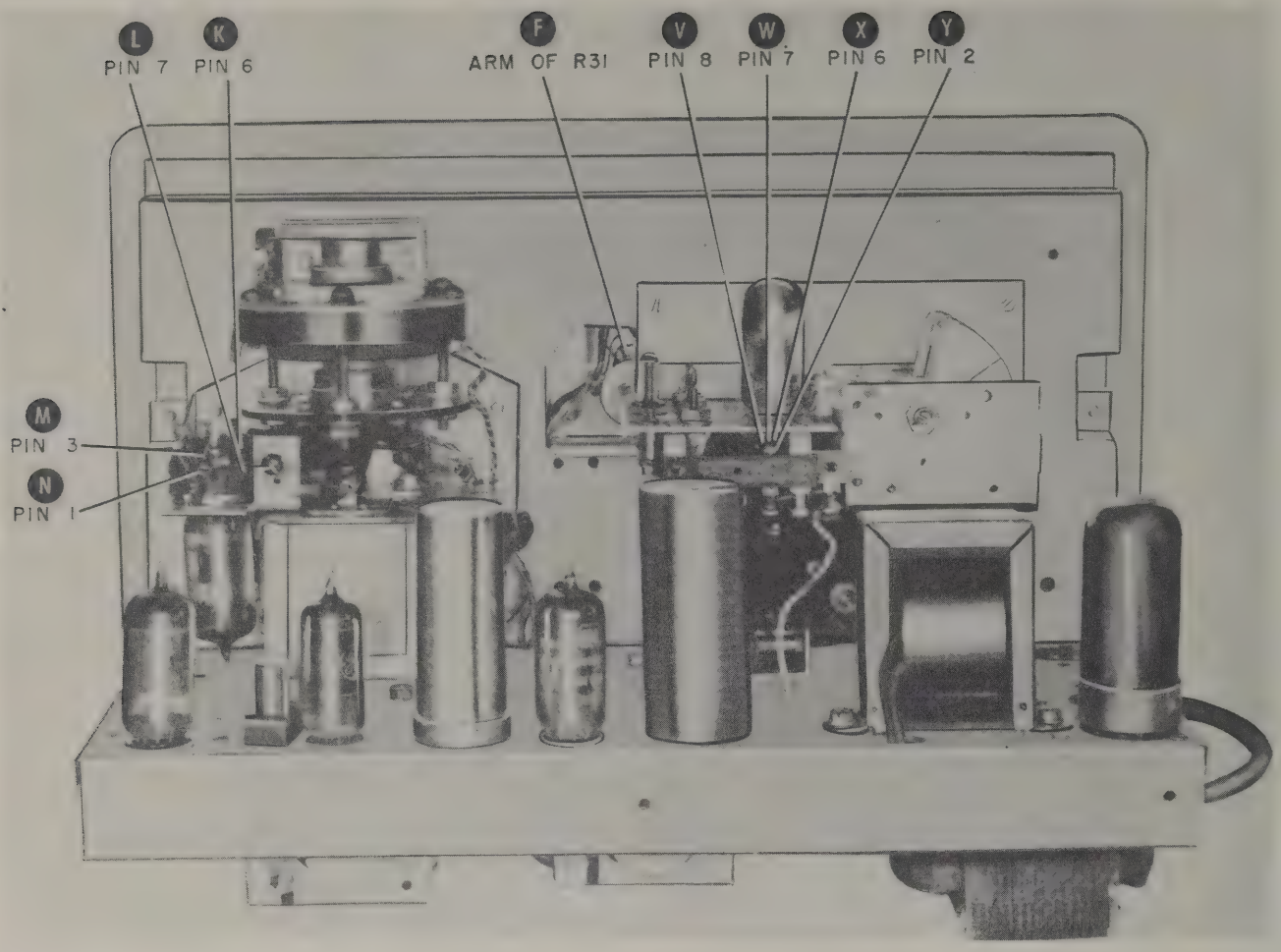

Figure 6-1. Generator, Sweep SG-93/URM-75, Rear View, Showing Location of Test Points

TABLE 6-3
CIRCUIT TROUBLE-SHOOTING CHART

Step	*Test Point*	*Test-Equipment Control Settings*	*Sweep-Generator Control Settings*	*Normal Indication*	*Possible Cause of Abnormal Indication*
1	① BIAS jack	Control settings of Test Set TS-352/U: Set FUNCTION switch to 20,000 Ω/V DC. Connect test leads to COMM. pin jack and 50 V pin jack.	Set SWEEP RANGE switch to OFF, MARKER RANGE switch to OFF, SELECT switch to OFF, and BIAS control fully clockwise. Insert power cord in a-c outlet, and advance PWR control to "on".	A reading of approximately −12 volts dc, should be obtained between BIAS jack and ground terminals. If normal indication is obtained, proceed to step 9.	Proceed to step 2.

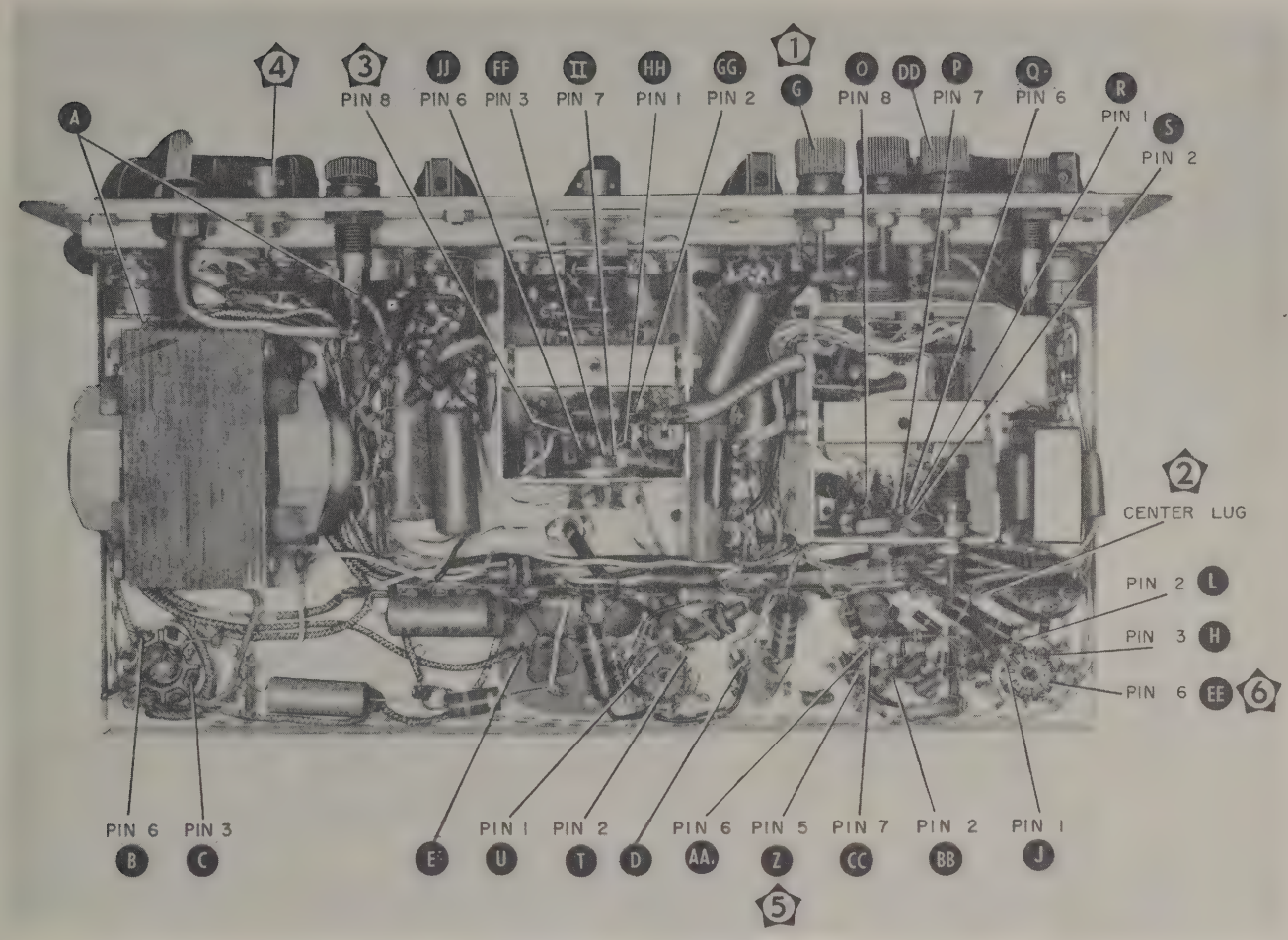

Figure 6-2. Generator, Sweep SG-93/URM-75, Bottom View, Showing Location of Test Points

TABLE 6-3 (Continued)

Step	*Test Point*	*Test-Equipment Control Settings*	*Sweep-Generator Control Settings*	*Normal Indication*	*Possible Cause of Abnormal Indication*
2	(A) Across primary of T2	Control settings of Test Set TS-352/U: Set FUNCTION switch to AC VOLTS, connect test leads to COMM. pin jack and 250 V pin jack on right side of meter.	Same as step 1.	A reading of 110—115 volts should be obtained. If normal indication is obtained, proceed to step 3.	Power cord, S4, or F1.
3	(B) Pin 6 of V5	Same as step 2 except connect test leads between COMM. pin jack and 500 V pin jack on right side of meter.	Same as step 1.	A reading of 250 volts, ac, should be obtained on meter. If normal indication is obtained, proceed to step 4.	Check half of secondary between pin 6 of V5 and center tap.

TABLE 6-3 (Continued)

Step	*Test Point*	*Test-Equipment Control Settings*	*Sweep-Generator Control Settings*	*Normal Indication*	*Possible Cause of Abnormal Indication*
4	ⓒ Pin 3 of V5	Same as step 3.	Same as step 1.	Same as step 3. If normal indication is obtained proceed to step 5.	Check half of secondary between pin 3 and center tap.
5	ⓓ Positive terminal C42	Control settings of Test Set TS-352/U: Set FUNCTION switch to 20,000 Ω/V DC, and connect test leads to COMM. pin jack and 250 V pin jack on left side of meter.	Same as step 1.	A reading of 180 volts should be obtained on meter. If normal indication is obtained proceed to step 6.	V5, L15, C44, R33, C42, C37, or C78.
6	ⓔ Center tap of T2	Same as step 5 except connect test leads to COMM. pin jack and 50 V pin jack.	Same as step 1	A reading of −12 volts should be indicated on meter. If normal indication is obtained, proceed to step 7.	C43 or C40.
7	ⓕ Arm of BIAS control (R31)	Same as step 6.	Same as step 1 except vary BIAS control through its range.	Meter reading should vary from 0 to −10 volts. If normal indication is obtained, proceed to step 8.	R31.
8	ⓖ BIAS jack	Same as step 6.	Same as step 1.	Meter reading should be −12 volts.	R35, C47, J5, or circuit wiring.
9	② White lead on T1	Control settings of Test Set TS-352/U: Set FUNCTION switch to AC, and connect test leads to COMM. pin jack and 50 V pin jack.	Set SWEEP RANGE switch to OFF, and SELECT switch to MOD. MKR.	With a .01-μf capacitor in series with positive test lead, a reading of 20 volts should be obtained on meter. If normal indication is obtained, proceed to step 13.	Proceed to step 10.
10	ⓗ Pin 3 of V3	Control settings of Test Set TS-352/U: Set FUNCTION switch to 20,000 Ω/V. Connect test leads to COMM. and 10 V pin jacks.	Same as step 9.	A reading of 5 volts should be obtained on meter. If normal indication is obtained proceed to step 11.	V3 or R14.

TABLE 6-3 (Continued)

Step	*Test Point*	*Test-Equipment Control Settings*	*Sweep-Generator Control Settings*	*Normal Indication*	*Possible Cause of Abnormal Indication*
11	(I) Pin 2 of V3	Same as step 10.	Same as step 9.	A reading of 0 volt or a slight negative voltage should be obtained. If normal indication is obtained, proceed to step 12.	R13, C22, or C23.
12	(J) Pin 1 of V3	Same as step 10, except connect test leads to COMM. pin jack and 250 V pin jack on left side of meter.	Same as step 9.	A reading of 165 volts should be obtained on meter.	Windings of T1.
13	⑧ Pin 8 of V8	Control settings of Electronic Multimeter ME-6A/U: Set SCALE SELECTOR switch to .05 and METER switch to AC.	Set SWEEP RANGE switch to A, SELECT switch to OFF, and BLANKING control to center of its range. Connect detector box to test point, and measure voltage at output of detector box.	Meter reading should be at least .01 volt. If normal indication is obtained, proceed to step 23.	Proceed to step 14.
14	(K) Pin 6 of V6	Control settings of Test Set TS-352/U: Set FUNCTION switch to 20,000 Ω/V, and connect test leads to COMM. pin jack and 250 V pin jack on left side of meter.	Same as step 13.	A reading of 130 volts should be obtained on meter. If normal indication is obtained, proceed to step 15.	R43, C55, L19, or contacts of S5A.
15	(L) Pin 7 of V6	Same as 14 except connect test leads to COMM. and 10 V pin jacks on left side of meter.	Same as step 13.	A reading of 6.5 volts should be obtained on meter. If normal indication is obtained, proceed to step 16.	C57, R41, C56, R42, R20, C52, R38, C53, R39, C51, or V6.
16	(M) Pin 3 of V6	Same as step 15.	Same as step 13.	A reading of zero or slightly positive should be obtained on meter. If normal indication is obtained proceed to step 17.	R54, V6, or C57.

TABLE 6-3 (Continued)

Step	*Test Point*	*Test-Equipment Control Settings*	*Sweep-Generator Control Settings*	*Normal Indication*	*Possible Cause of Abnormal Indication*
17	(N) Pin 1 of V6	Same as step 14 except connect test leads to COMM. pin jack and 250 V pin jack on left side of meter.	Same as step 13.	A reading of 130 volts should be obtained on meter. If normal indication is obtained, proceed to step 18.	L27, R44, C59, or R46.
18	(O) Pin 8 of V7	Same as step 14 except connect test leads to COMM. and 25 V pin jacks.	Same as step 13.	A reading of 1.6 volts should be obtained on meter. If normal indication is obtained, proceed to step 19.	R53, C69, or V7.
19	(P) Pin 7 of V7	Same as step 14 except connect leads to COMM. and 2.5 V pin jacks.	Same as step 13.	A reading of 0 volt or slightly negative should be obtained on meter. If normal indication is obtained, proceed to step 20.	C68, R54, or C60.
20	(Q) Pin 6 of V7	Same as step 14 except connect leads to COMM. and 250 V pin jacks.	Same as step 13.	A reading of 85 volts should be obtained on meter. If normal indication is obtained, proceed to step 21.	R51, S5A, L25, R52, L26, C70, or C71.
21	(R) Pin 1 of V7	Same as step 20.	Same as step 13.	A reading of 70 volts should be obtained on meter. If normal indication is obtained, proceed to step 22.	R50, L23, C65, C64, C62, or L22.
22	(S) Pin 3 of V7	Same as step 14 except connect test leads to COMM. and 2.5 V pin jacks.	Same as step 13.	A reading of 0 volt or a slightly negative voltage should be indicated on meter.	C61, C63, or R49.
23	(4) MKR. OUT jack	Control settings of Electronic Multimeter ME-6A/U: Set SCALE SELECTOR switch to .05, and METER switch to AC.	Set SWEEP RANGE switch to OFF, and SELECT switch to MOD. MKR. Connect detector-box input to test point, and measure output.	A reading of at least .02 volt should be obtained on meter. If normal indication is obtained, proceed to step 30.	Proceed to step 24.

TABLE 6-3 (Continued)

Step	*Test Point*	*Test-Equipment Control Settings*	*Sweep-Generator Control Settings*	*Normal Indication*	*Possible Cause of Abnormal Indication*
24	(T) Pin 2 of V4	Control settings of Test Set TS-352/U: Set FUNCTION switch to 20,000 Ω/V, and connect test leads to COMM. pin jack and 2.5 V pin jack on left side of meter.	Same as step 23.	A reading of −.7 volt should be obtained on meter. If normal indication is obtained, proceed to step 25.	R23, C32, or V4.
25	(U) Pin 1 of V4	Same as step 24 except connect test leads to COMM. pin jack and 250 V pin jack on left side of meter.	Same as step 23.	A reading of 75 volts should be obtained on meter. If normal indication is obtained, proceed to step 26.	C33, L13, C34, R30, C36, R27, or C38.
26	(V) Pin 8 of V1	Same as step 25.	Same as step 23.	A reading of 102 volts should be obtained on meter. If normal indication is obtained, proceed to step 27.	R3, V1, or C5.
27	(W) Pin 7 of V1	Same as step 25.	Same as step 23.	A reading of 100 volts should be obtained on meter. If normal indication is obtained, proceed to step 28.	R4, C6, or C7.
28	(X) Pin 6 of V1	Same as step 25.	Same as step 23.	A reading of 165 volts should be obtained on meter. If normal indication is obtained, proceed to step 29.	R2, C2, R21, C31, L12.
29	(Y) Pin 2 of V1	Same as step 25 except connect test leads to COMM. pin jack and 2.5 V pin jack on left side of meter.	Same as step 23 except rotate MARKER RANGE switch through all positions while observing meter.	A reading of −.2 volt should be obtained on meter.	R1, C1, L4, L5, L6, L7, L8, L9, C8, C9, C10, C11, C13, C14, C12, S1A, S1B, S1C, or S1D.
30	⑤ Pin 5 of V2	Use .5-volt scale of ME-6A/U. Control settings of Electronic Multimeter ME-6A/U are as follows: Set SCALE SELECTOR switch to .05, and METER switch to AC.	Set SWEEP RANGE switch to OFF, and SELECT switch to MOD. XTAL. Connect detector-box input to test point, and measure output voltage of detector box.	A reading of at least .2 volt should be obtained on meter. If normal indication is obtained, proceed to step 35.	Proceed to step 31.

TABLE 6-3 (Continued)

Step	*Test Point*	*Test-Equipment Control Settings*	*Sweep-Generator Control Settings*	*Normal Indication*	*Possible Cause of Abnormal Indication*
31	Ⓩ Pin 5 of V5	Control settings of Test Set TS-352/U: Function switch to 20,000 Ω/V, and connect test leads to COMM. pin jack and 250 V pin jack at left side of meter.	Same as step 30.	A reading of 125 volts should be obtained on meter. If normal indication is obtained, proceed to step 32.	R11, C21, R20, R22, R25, CR1, C30, or V2.
32	ⒶⒶ Pin 6 of V2	Same as step 31.	Same as step 30.	A reading of 145 volts should be obtained on meter. If normal indication is obtained, proceed to step 33.	C20, R12, or S3B.
33	ⒷⒷ Pin 2 of V2	Same as step 31 except connect test leads to COMM. pin jack and 2.5 V pin jack.	Same as step 30.	A reading of 0 volt or a slightly positive voltage should be indicated on meter. If normal indication is obtained, proceed to step 34.	C18, R10, L10, C17, R6, or Y1.
34	ⒸⒸ Pin 7 of V2	Same as step 33.	Same as step 30.	A reading of −1.4 volts should be obtained on meter.	C19, R9, R7, R8, or C16.
35	⑥ Pin 6 of V3	Control setting of Test Set TS-352/U: Set FUNCTION switch to AC. Connect test leads to COMM. pin jack and 250 V pin jack on right side of meter.	Set BLANKING control to center of its range, and PHASING control to center of its range.	With a .01-μf blocking capacitor in series with test lead, a reading of 50 volts should be obtained on meter.	Proceed to step 36.
36	ⒹⒹ SCOPE jack	Same as step 35 except connect test leads to COMM. pin jack and 2.5 V pin jack on right side of meter.	Same as step 35.	A reading of .6 volt should be obtained on meter. If normal indication is obtained, proceed to step 37.	C28, R19, C26, R17, R16, C24, C25, or R15.

TABLE 6-3 (Continued)

Step	*Test Point*	*Test-Equipment Control Settings*	*Sweep-Generator Control Settings*	*Normal Indication*	*Possible Cause of Abnormal Indication*
37	(EE) Pin 6 of V3	Control settings of Test Set TS-352/U: Set FUNCTION switch to 20,000 Ω/V, and connect test leads to COMM. jack and 250 V pin jack on left side of meter.	Same as step 35.	A reading of 145 volts should be obtained on meter.	R18, C27, S2, or CR2.
38	(7) MIXED OUTPUT jack	Connect oscilloscope vertical input to output of detector box, and input of detector box to test point.	Set SELECT switch to MOD. MKR., OUTPUT LEVEL control to HIGH, and MARKER LEVEL control to 10.	A 600-cycle sine-wave signal should appear on oscilloscope screen.	Proceed to step 39.
39	(FF) Pin 3 of V8	Control settings of Test Set TS-352/U: Set FUNCTION switch to 20,000 Ω/V, and connect test leads to COMM. pin jack and 2.5 V pin jack on left side of meter.	Same as step 38.	A reading of .6 volt should be obtained on meter. If normal indication is obtained, proceed to step 40.	R66, R30, C36, or R27A.
40	(GG) Pin 2 of V8	Same as step 39.	Same as step 38.	A reading of −1.2 volts should be obtained on meter. If normal indication is obtained, proceed to step 41.	R65, C76, C75, R64, C39, C41, L14, R27B, or V8.
41	(HH) Pin 1 of V8	Same as step 39 except connect test leads to COMM. pin jack and 250 V pin jack on left side of meter.	Same as step 38.	A reading of 145 volts should be obtained on meter. If normal indication is obtained, proceed to step 42.	C73, R67, C78, or C77.
42	(II) Pin 7 of V8	Same as step 39.	Same as step 38.	A reading of −1.4 volts should be obtained on meter. If normal indication is obtained, proceed to step 43.	R70, C80, R72, R71, or C45.
43	(JJ) Pin 6 of V8	Same as step 41.	Same as step 38.	A reading of 75 volts should be obtained on meter.	R68 or V8.

6-19. TUBE-SOCKET VOLTAGE AND RESISTANCE DATA.

6-20. Very often the trouble-shooting of an equipment resolves itself into isolating the trouble by measuring voltages and resistances at various points throughout the circuit. TABLE 6-4 contains a list of voltages and resistances measured at the tube sockets under the conditions indicated. See figures 7-6 and 7-7 for the location of the tube sockets and the orientation of the pins. All measurements are taken with respect to the chassis.

TABLE 6-4
TUBE-SOCKET VOLTAGES AND RESISTANCES

Tube	*Pin No.*	*Switch Positions*	*Meter Scale*	*Reading*
V1	1	SELECT switch at CAL.	250V DC R x 10,000	85 volts Infinity
	2		2.5V DC R x 10,000	−.2 12,000 ohms
	3		2.5V DC R x 1	0 volt Less than 1 ohm
	4		2.5V AC R x 1	0 volt Less than 1 ohm
	5		10V AC R x 1	6.3 volts, ac Less than 1 ohm
	6		250V DC R x 10,000	165 volts 30K
	7		250V DC R x 10,000	100 volts Infinity
	8		250V DC R x 10,000	102 volts Infinity
	9		2.5V DC R x 1	0 volt 0 ohm
V2	1	SELECT switch at CAL.	2.5V DC R x 10,000	−.3 volt 1 megohm
	2		2.5V DC R x 1	0 volt 10 ohms
	3		2.5V AC R x 1	0 volt 0 ohm
	4		10V AC R x 1	6.3 volts, ac Less than 1 ohm
	5		250V DC R x 10,000	125 volts 30,000 ohms
	6		250V DC R x 10,000	145 volts 30,000 ohms
	7		2.5V DC R x 10,000	—1.4 volts 700,000 ohms

TABLE 6-4 (Continued)

Tube	*Pin No.*	*Switch Positions*	*Meter Scale*	*Reading*
V3	1	SELECT switch at MOD. MKR.	250V DC R x 10,000	165 volts 30,000 ohms
	2	BLANKING control "on" and at center of its range.	2.5V DC R x 10,000	0 volt 56,000 ohms
	3		10V DC R x 100	5 volts 470 ohms
	4		10V AC R x 1	6.3 volts, ac Less than 1 ohm
	5		10V AC R x 1	6.3 volts, ac Less than 1 ohm
	6		250V DC R x 10,000	80 volts 100,000 ohms
	7		10V DC R x 1000	−4 volts 25,000 ohms
	8		2.5V DC R x 1	0 volt 0 ohm
	9		2.5V DC R x 1	0 volt 0 ohm
V4	1	SELECT switch at CAL.	205V DC R x 10,000	75 volts 40,000 ohms
	2		2.5V DC R x 1000	−.7 volt 100,000 ohms
	3		2.5V DC R x 1	0 volt 0 ohm
	4		2.5V AC R x 1	0 volt 0 ohm
	5		10V AC R x 1	6.3 volts, ac Less than 1 ohm
	6		250V DC R x 10,000	50 volts 50,000 ohms
	7		2.5V DC R x 10,000	−1.3 volts 18,000 ohms
	8		2.5V DC R x 1	0 volt 0 ohm
	9		2.5V DC R x 1	0 volt 0 ohm

TABLE 6-4 (Continued)

Tube	*Pin No.*	*Switch Positions*	*Meter Scale*	*Reading*
V5	1		2.5V AC R x 1	0 volt 0 ohm
	2			No connection
	3		500V AC R x 10	270 volts, ac 400 ohms
	4			No connection
	5			No connection
	6		500V AC R x 10	250 volts, ac 400 ohms
	7		250V DC R x 10,000	240 volts 25,000 ohms
	8		10V AC R x 1	6.3 volts, ac Less than 1 ohm
V6	1	SWEEP RANGE control at A.	250V DC R x 10,000	160 volts 30,000 ohms
	2	BLANKING control at center of its range.	2.5V DC R x 1	0 volt 0 ohm
	3		2.5V AC R x 1	1.7 volts 220 ohms
	4	SWEEP WIDTH control at center of its range.	2.5V DC R x 10	0 volt 0 ohms
	5		10V AC R x 1	6.3 volts 0 ohms
	6		220V DC R x 10,000	130 volts 40,000 ohms
	7		10V DC R x 1000	6.7 volts 48,000 ohms
	8		2.5V DC R x 1	0 volt 0 ohm
	9		2.5V DC R x 1	0 volt 0 ohm

TABLE 6-4 (Continued)

Tube	*Pin No.*	*Switch Positions*	*Meter Scale*	*Reading*
V7	1	SWEEP RANGE control at A.	250V DC R x 10,000	70 volts 50,000 ohms
	2	BLANKING control at center of its range.	2.5V DC R x 10,000	−1.6 volts 10,000 ohms
	3	SWEEP WIDTH control at center of its range.	2.5V DC R x 1	0 volt 0 ohm
	4		10V AC R x 1	6.3 volts, ac Less than 1 ohm
	5		2.5V AC R x 1	0 volt 0 ohm
	6		250V DC R x 10,000	85 volts 60,000 ohms
	7		2.5V DC R x 1000	0 volt 10,000 ohms
	8		2.5V DC R x 1	1.6 volts 560 ohms
	9		2.5V DC R x 1	0 volt 0 ohm
V8	1	MARKER LEVEL control at center of range.	250V DC R x 10,000	145 volts 50,000 ohms
	2	BLANKING control at center of range.	2.5V DC R x 1000	−1.2 volts 40,000 ohms
	3	SWEEP LEVEL control at center of range.	2.5V DC R x 10	.6 volt 270 ohms
	4	SELECT switch at CAL.	2.5V AC R x 1	0 volt, ac 0 ohm
	5	SWEEP RANGE switch at A.	10V AC R x 1	6.3 volts, ac Less than 1 ohm
	6		250V DC R x 10,000	180 volts 30,000 ohms
	7		2.5V DC R x 1000	−1.4 volts 96,000 ohms
	8		2.5V DC R x 10	.8 volt 270 ohms
	9		2.5V DC R x 1	0 volt 0 ohm

6-21. REMOVAL AND REPLACEMENT OF ASSEMBLIES.

6-22. No attempt should be made by Field or FASRon maintenance personnel to remove any parts other than resistors and capacitors and those parts mentioned in Section V of this manual. For information concerning the removal of assemblies, refer to the Handbook of Overhaul Instructions for Generator, Sweep AN/URM-75, NAVAER 16-30URM75-503.

6-23. FASRON LUBRICATION PROCEDURE.

6-24. The equipment normally requires no lubrication; however, should binding of the gear drive for the MARKER FREQ. control and the SWEEP FREQ. control be encountered, a very small coating of oil meeting Specification MIL-L-6085 may be applied to alleviate this condition.

CAUTION

The friction-drive mechanism used between the front-panel control knob and the drive gears may slip if a lubricant is present on the mechanism.

SECTION VII

DRAWINGS

6-21. REMOVAL AND REPLACEMENT OF ASSEMBLIES.

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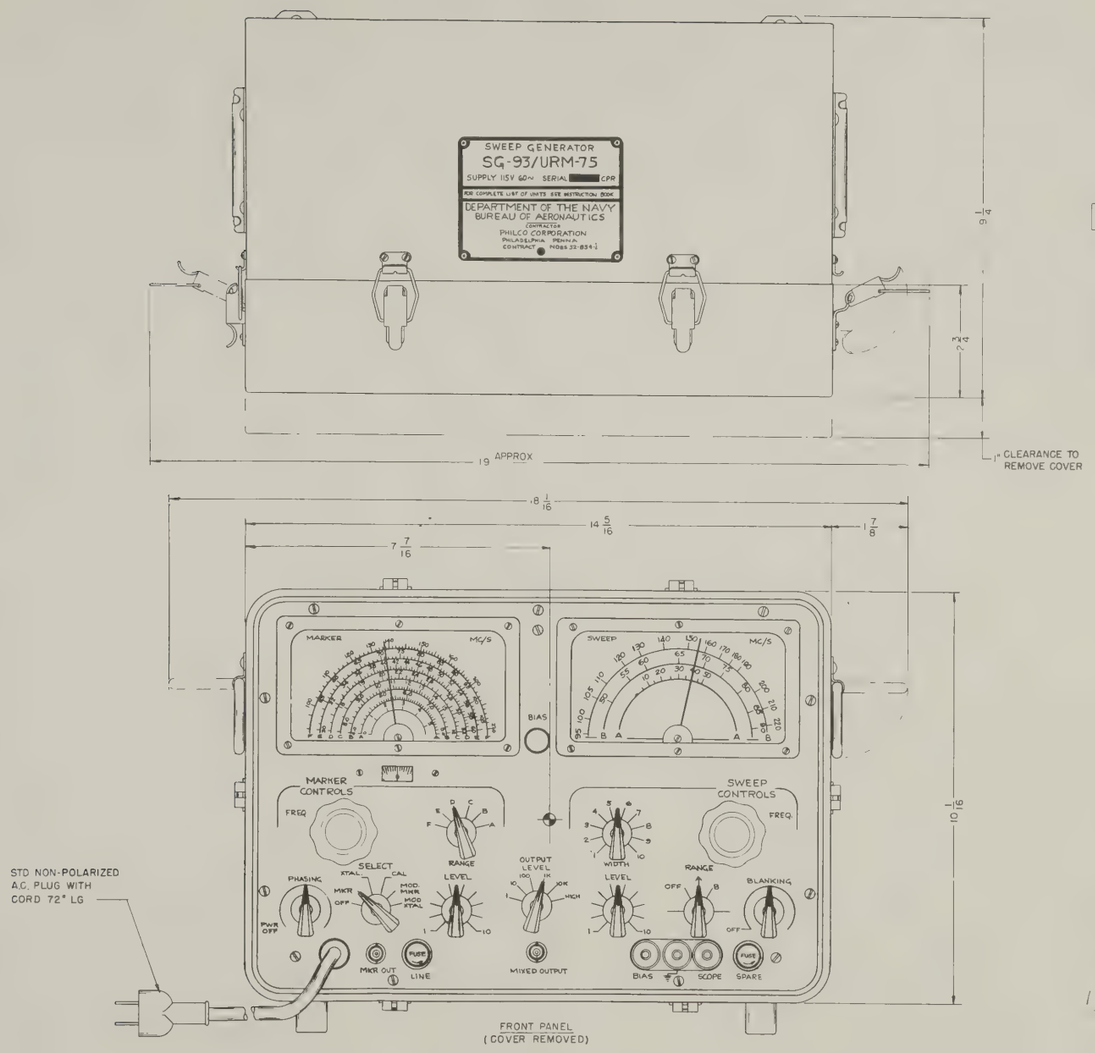
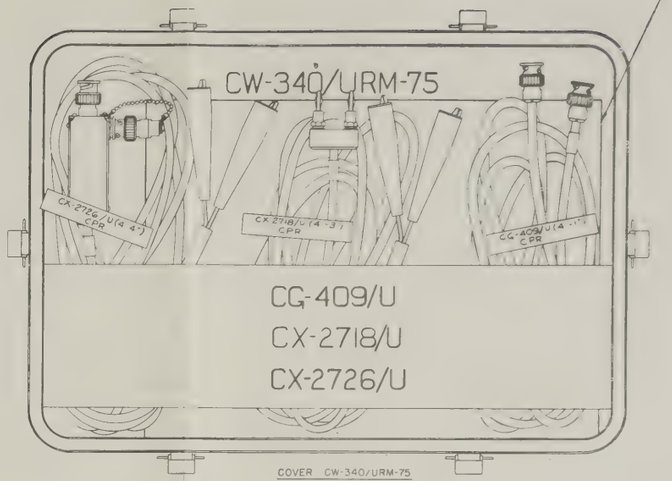
SECTION VII

DRAWINGS





— INSTRUCTION BOOKS:
NavAer 16-30URM75-501 HANDBOOK OPERATING INSTRUCTIONS
NavAer 16-30URM75-502 HANDBOOK SERVICE INSTRUCTIONS
NavAer 16-30URM75-503 HANDBOOK OVERHAUL INSTRUCTIONS
NavAer 16-30URM75-504 HANDBOOK PARTS BREAKDOWN

NOTES:
1. ALL DIMENSIONS ARE IN INCHES
2. WEIGHT OF UNIT UNCRATED 30LBS 4OZ
3. WEIGHT OF UNIT CRATED 34LBS 12OZ
4. CUBICAL CONTENT OF UNIT CRATED 3259.8 CU.IN.
5. OVERALL DIMENSIONS OF UNIT CRATED
$18\frac{3}{8}$ X $12\frac{7}{8}$ X $13\frac{3}{4}$ INCHES
6. HEAT DISSIPATION IN WATTS 50
7. DESIGNATES CENTERS OF GRAVITY (ESTIMATED)
8. AMBIENT TEMPERATURE OPERATING, 0° TO +45°C
NON-OPERATING, 0° TO +45°C
9. VACUMN TUBE REQUIREMENTS

REFERENCE SYMBOL	TUBE TYPE
V1	6BQ7
V2	6BJ6
V3	12AU7
V4	6BQ7
V5	7Z4
V6	6BQ7
V7	6BQ7
V8	6BQ7

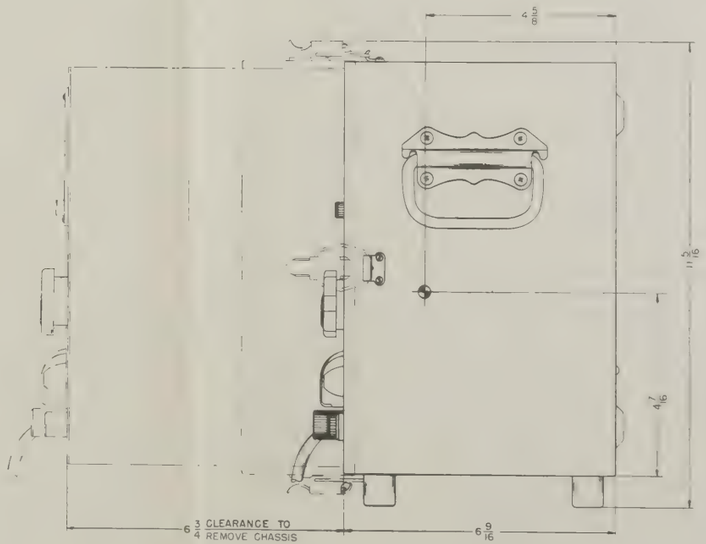


Figure 7-1. Generator, Sweep SG-93/URM-75, Outline Dimensional Diagram

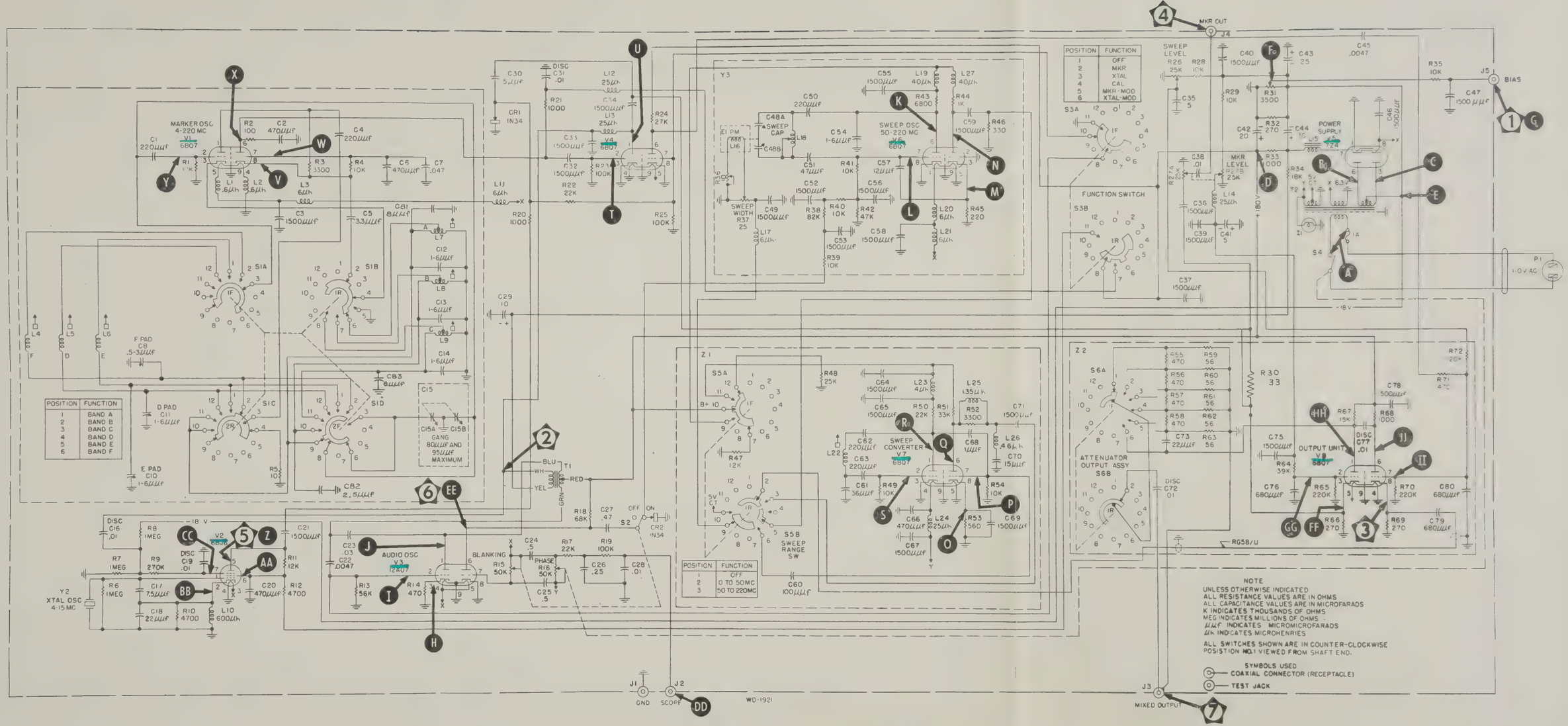


Figure 7-2. Generator, Sweep SG-93/URM-75, Schematic Diagram

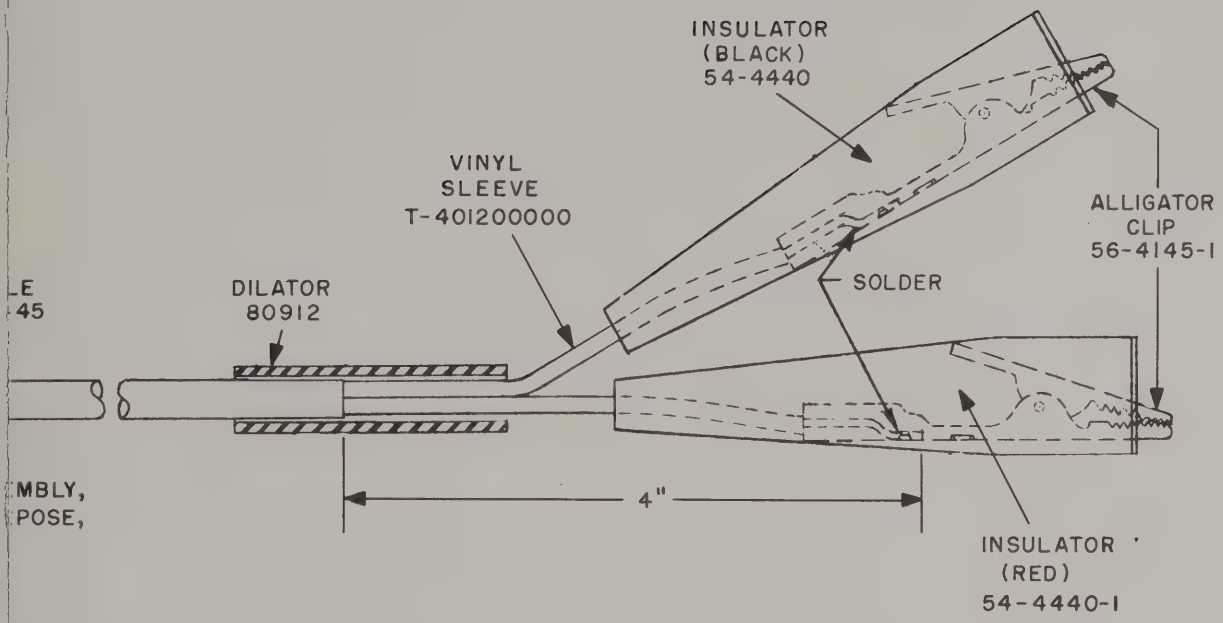


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Figure 7-3. Cable Assemblies, Special Purpose, Electrical CX-2726/U and CX-2718/U, Fabrication Drawing

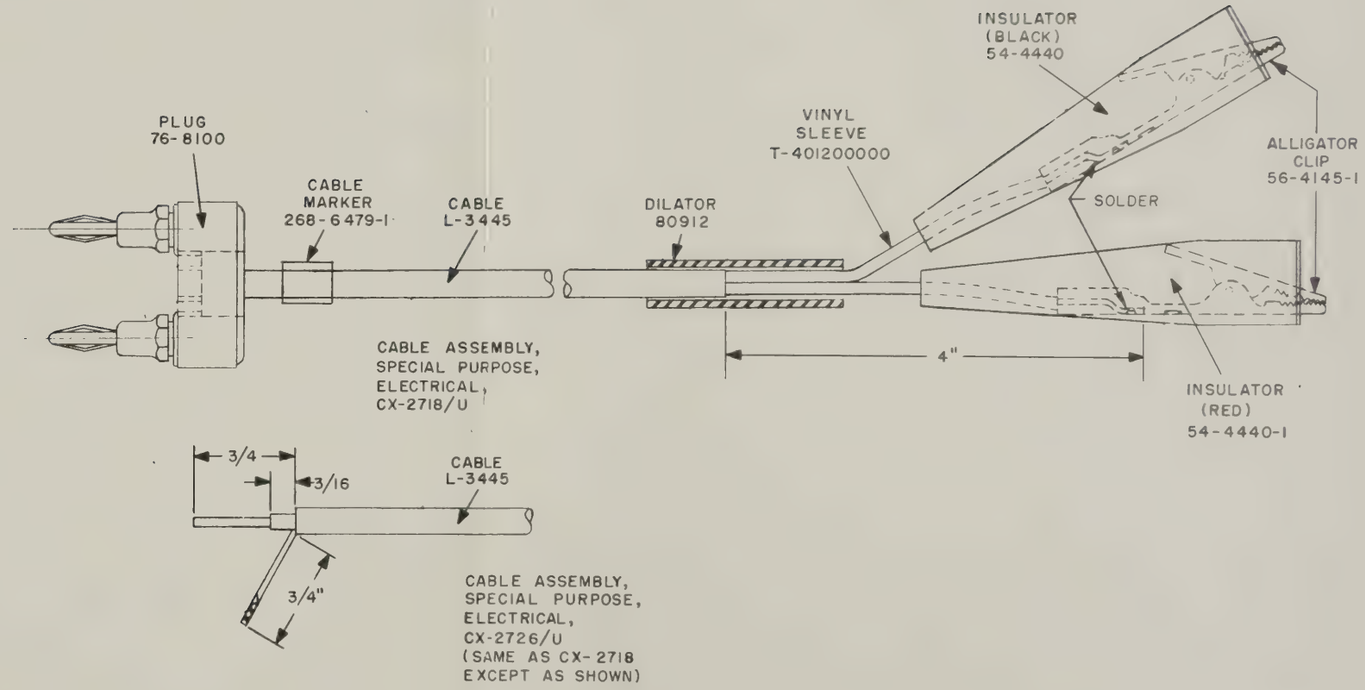


Figure 7-3. Cable Assemblies, Special Purpose, Electrical CX-2726/U and CX-2718/U, Fabrication Drawing

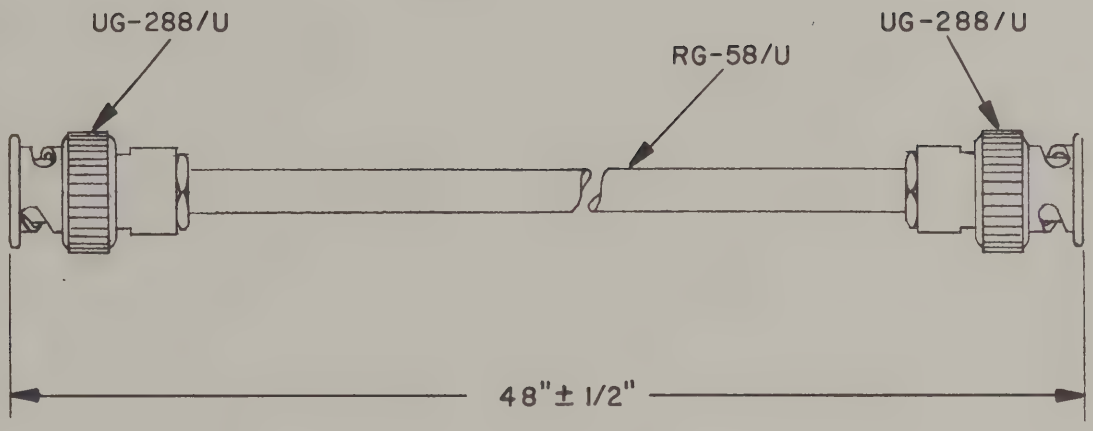


Figure 7-4. Cord CG-409/U, Fabrication Drawing

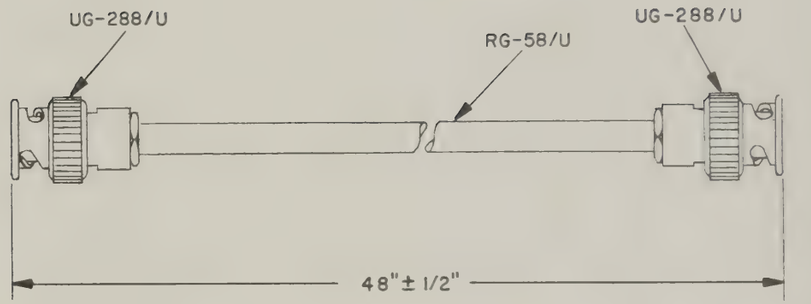
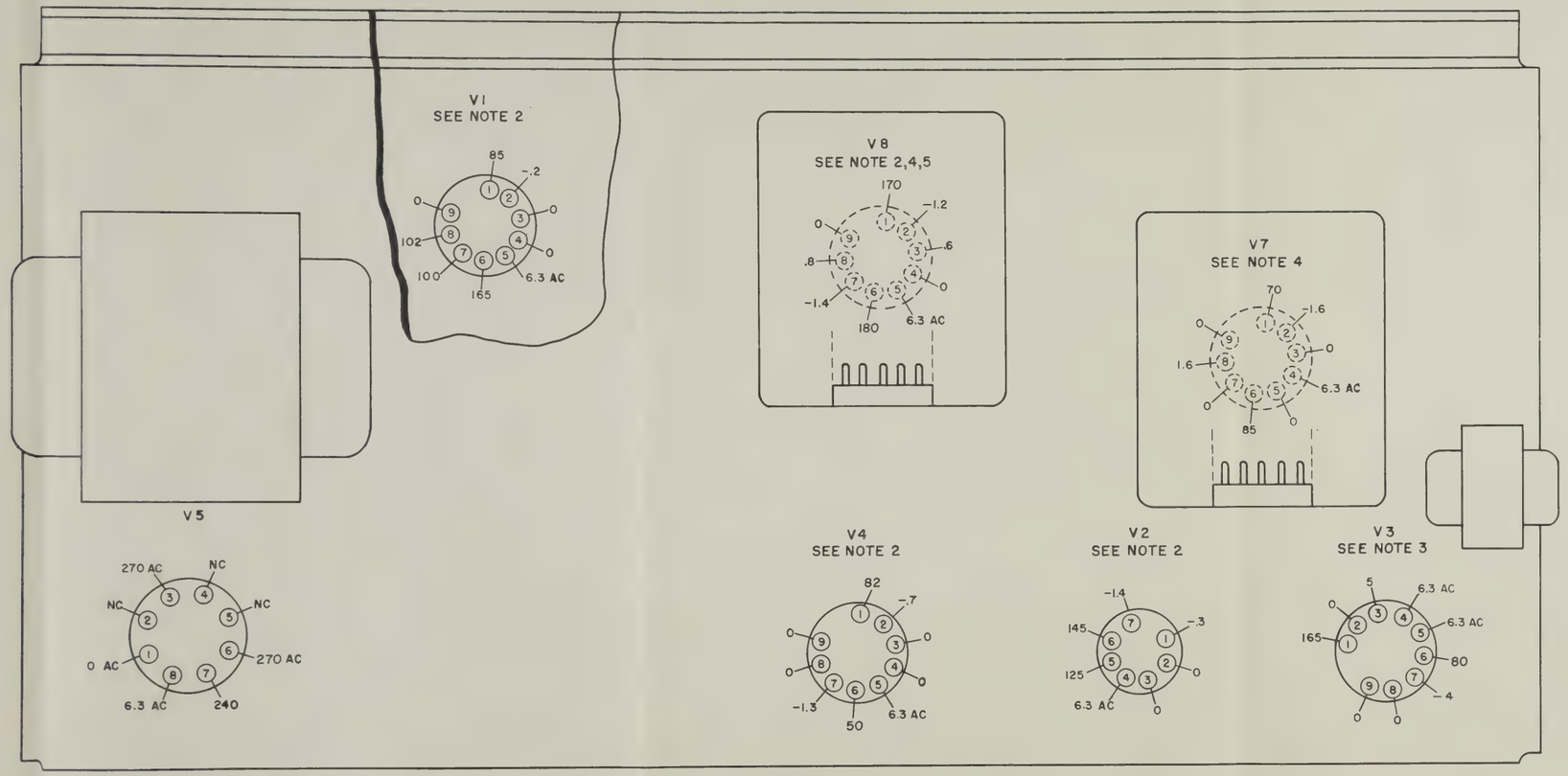
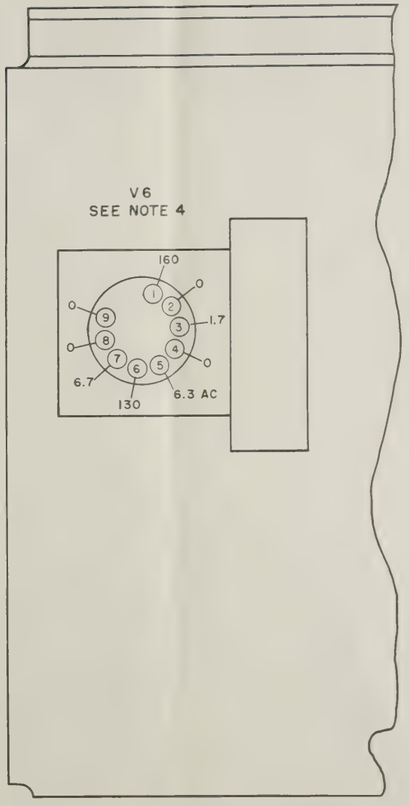


Figure 7-4. Cord CG-409/U, Fabrication Drawing



BOTTOM VIEW

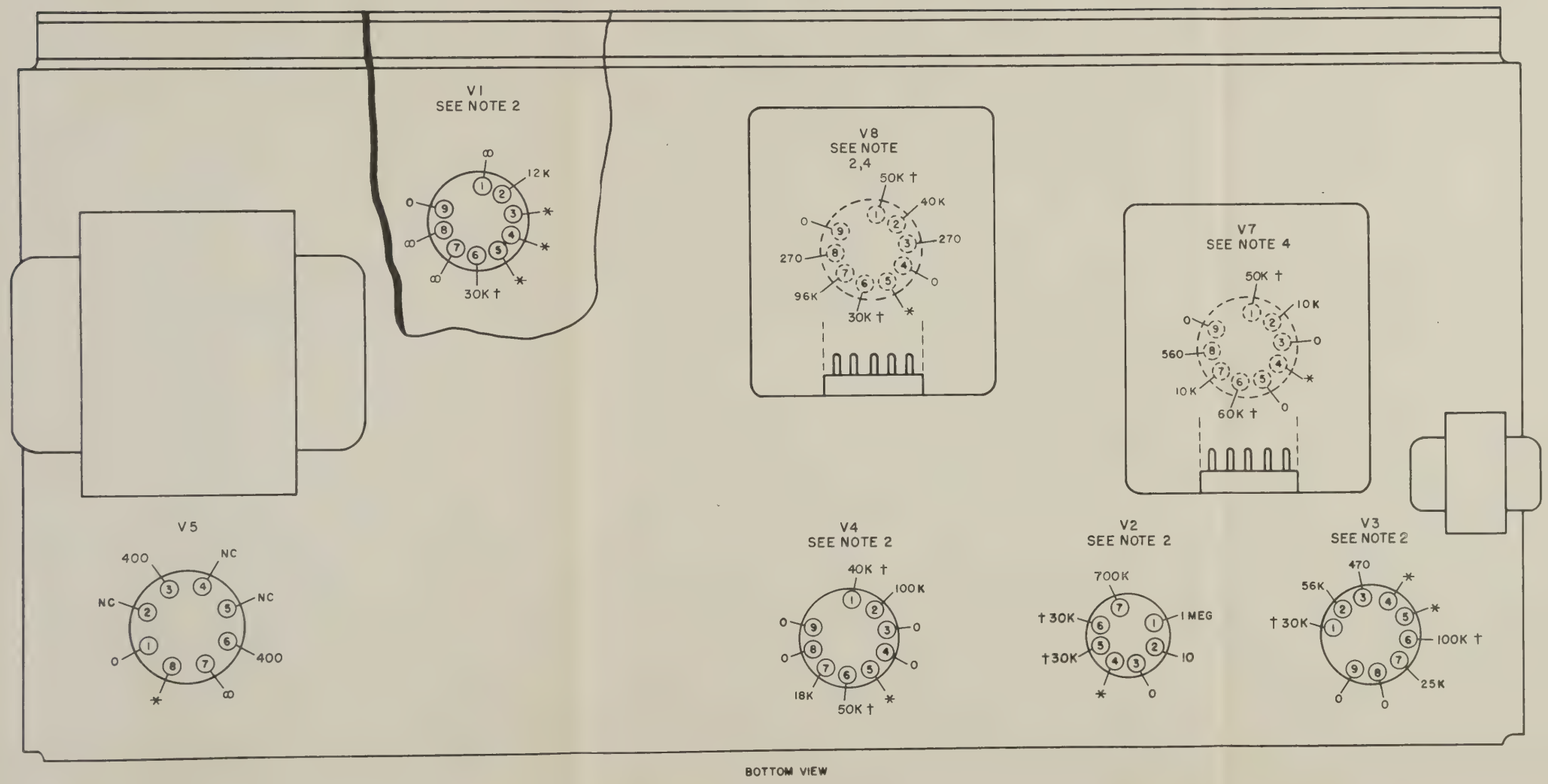


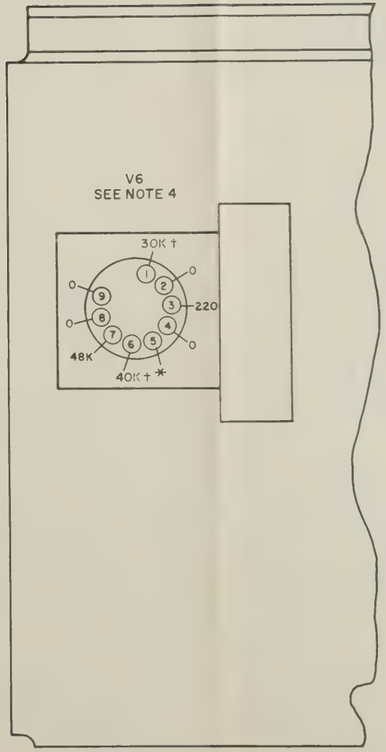
TOP VIEW

NOTES

1. ALL VOLTAGES MEASURED FROM PINS TO GROUND WITH 20,000 OHMS/VOLT METER. VOLTAGES ARE DC UNLESS OTHERWISE INDICATED.
2. SELECT SWITCH IN CAL. POSITION
3. SELECT SWITCH IN MOD. MKR POSITION
4. SWEEP RANGE SWITCH IN POSITION "A" BLANKING CONTROL CENTER OF RANGE, SWEEP WIDTH CENTER OF RANGE.
5. SWEEP LEVEL CONTROL CENTER OF RANGE, MARKER LEVEL CONTROL CENTER OF RANGE.

Figure 7-5. Generator, Sweep SG-93/URM-75, Voltage Diagram





NOTES:

1. ALL RESISTANCES ARE IN OHMS UNLESS OTHERWISE INDICATED.
   K INDICATES 1,000
   MEG INDICATES 1,000,000
2. SELECT SWITCH IN CAL. POSITION
3. SELECT SWITCH IN MOD. MKR POSITION
4. SWEEP RANGE SWITCH IN POSITION "A" BLANKING CONTROL CENTER OF RANGE, SWEEP WIDTH CONTROL CENTER OF RANGE, MARKER LEVEL CONTROL CENTER OF RANGE.
5. READINGS MARKED † MAY VARY AS THE ELECTROLYTIC CAPACITOR BECOMES CHARGED.

Figure 7-6. Generator, Sweep SG-93/URM-75, Resistance Diagram

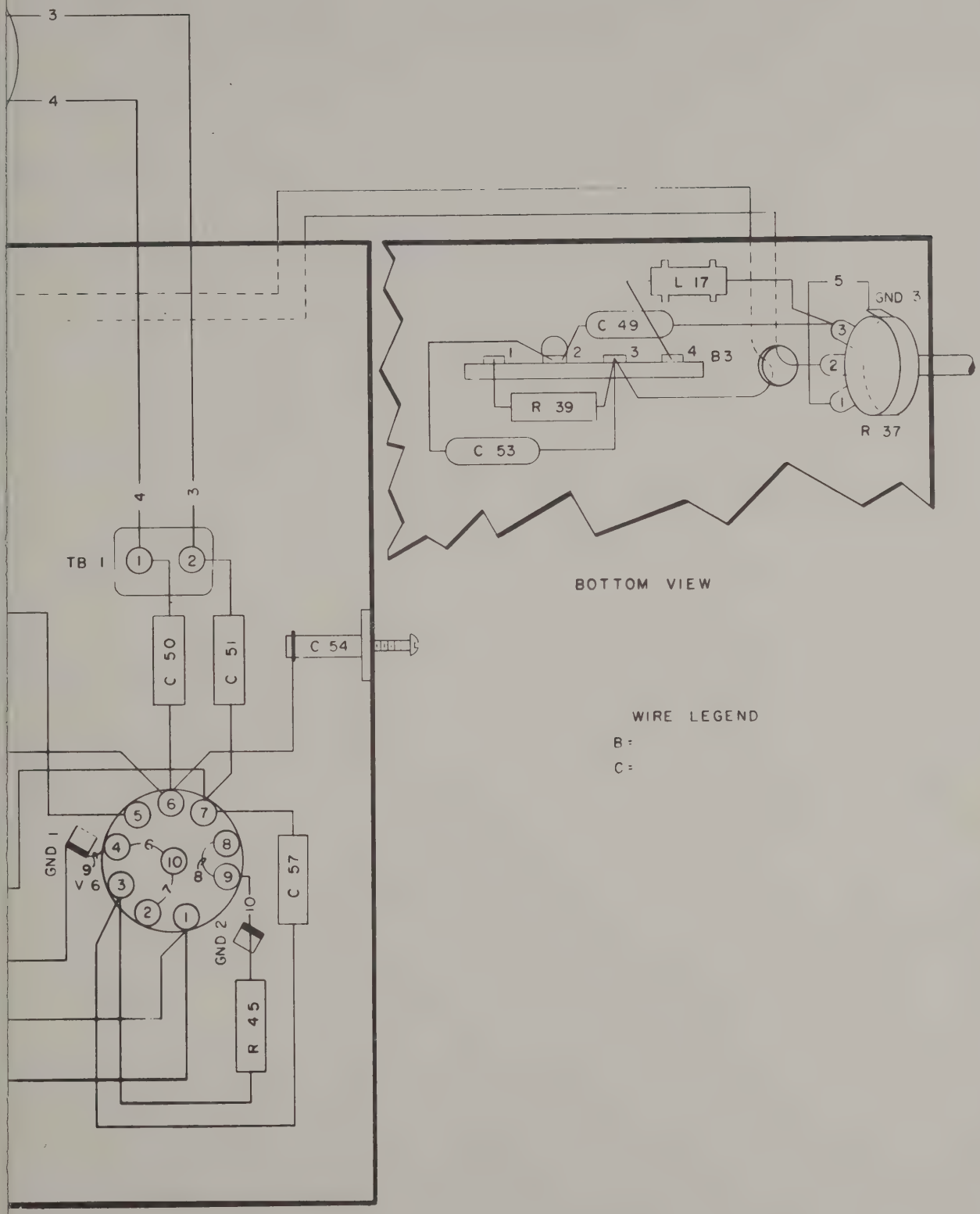


Figure 7-7. Sweep Oscillator, Practical Wiring Diagram

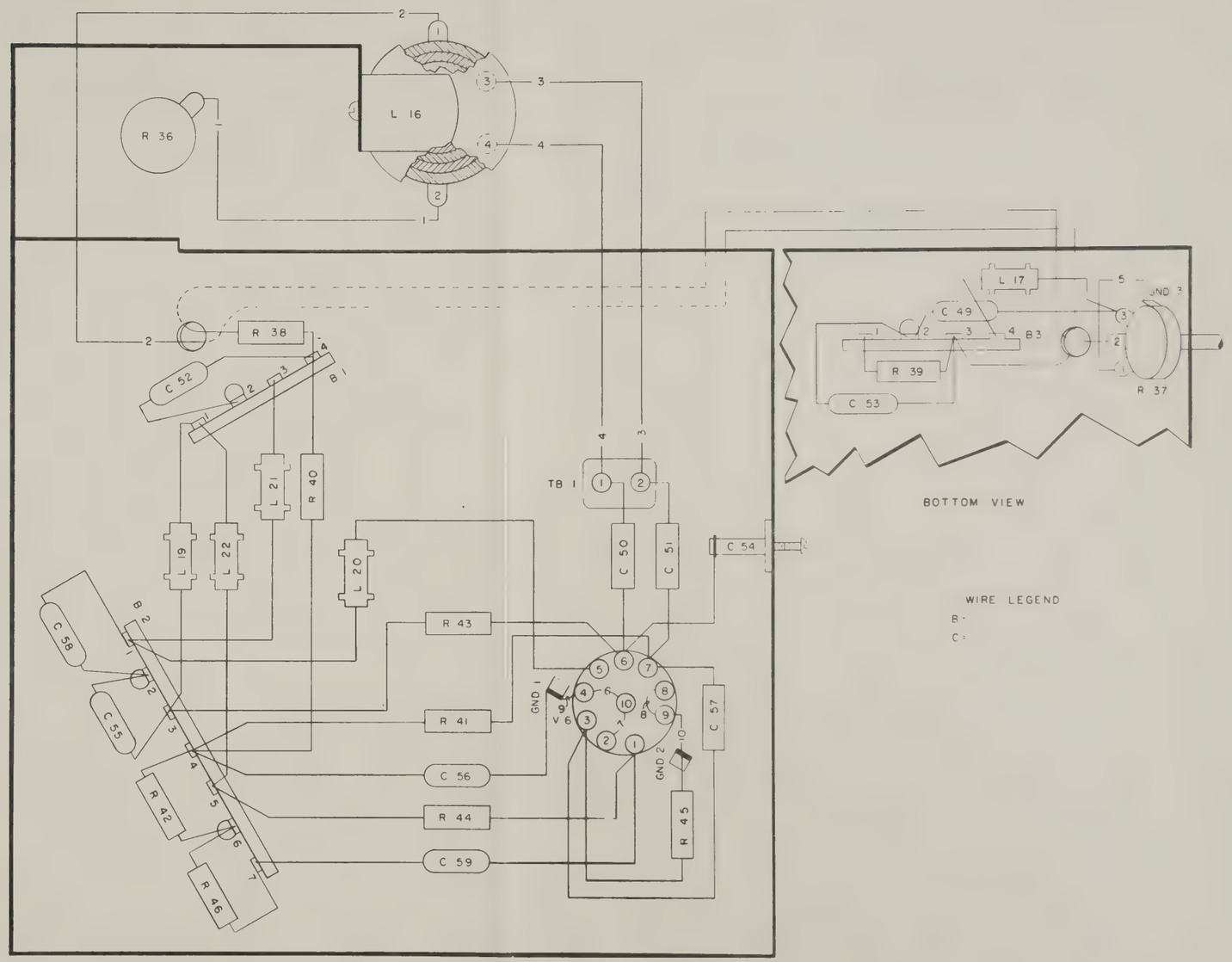


Figure 7-7. Sweep Oscillator, Practical Wiring Diagram

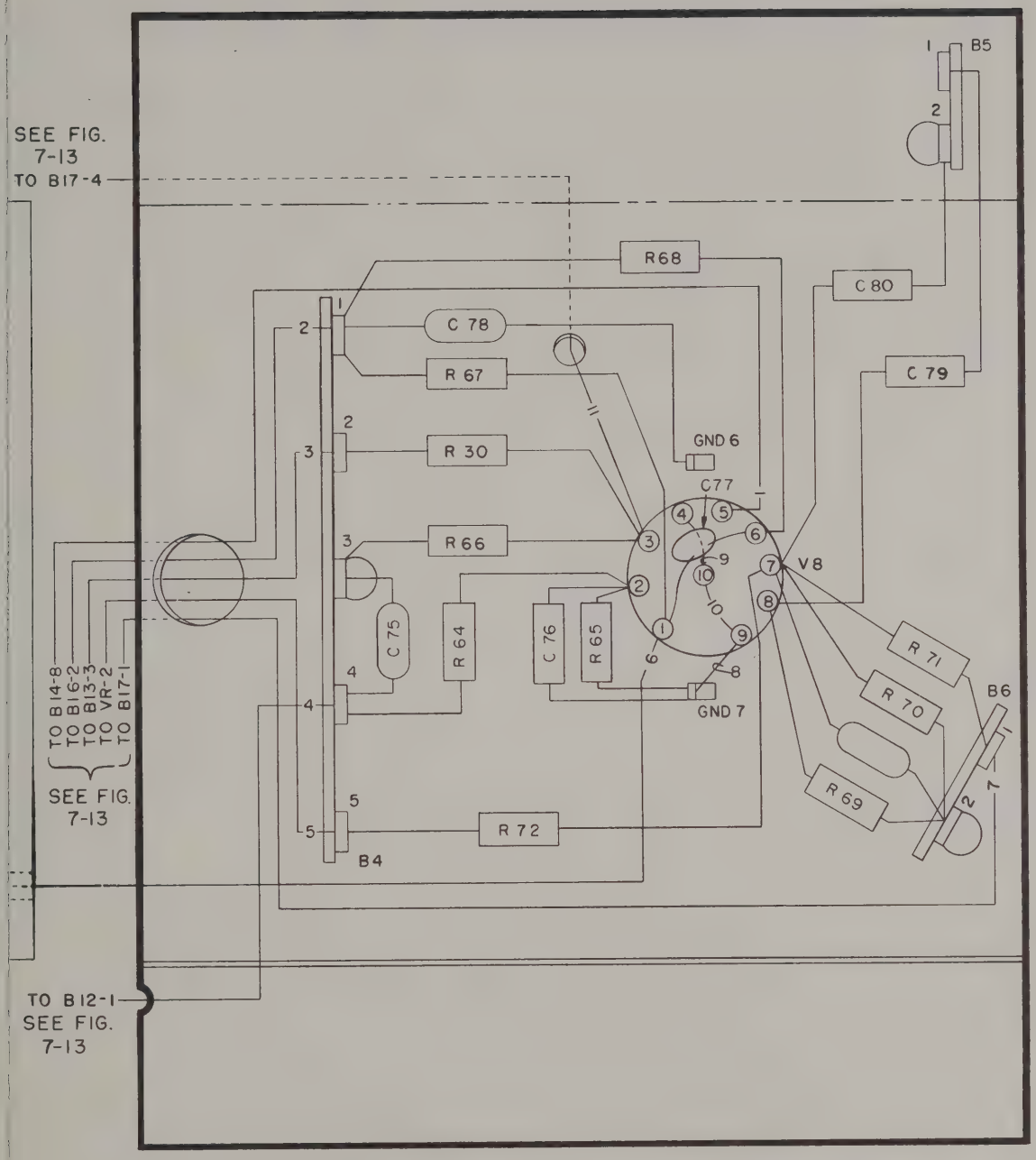


Figure 7-8. Output Attenuator-Mixer, Practical Wiring Diagram

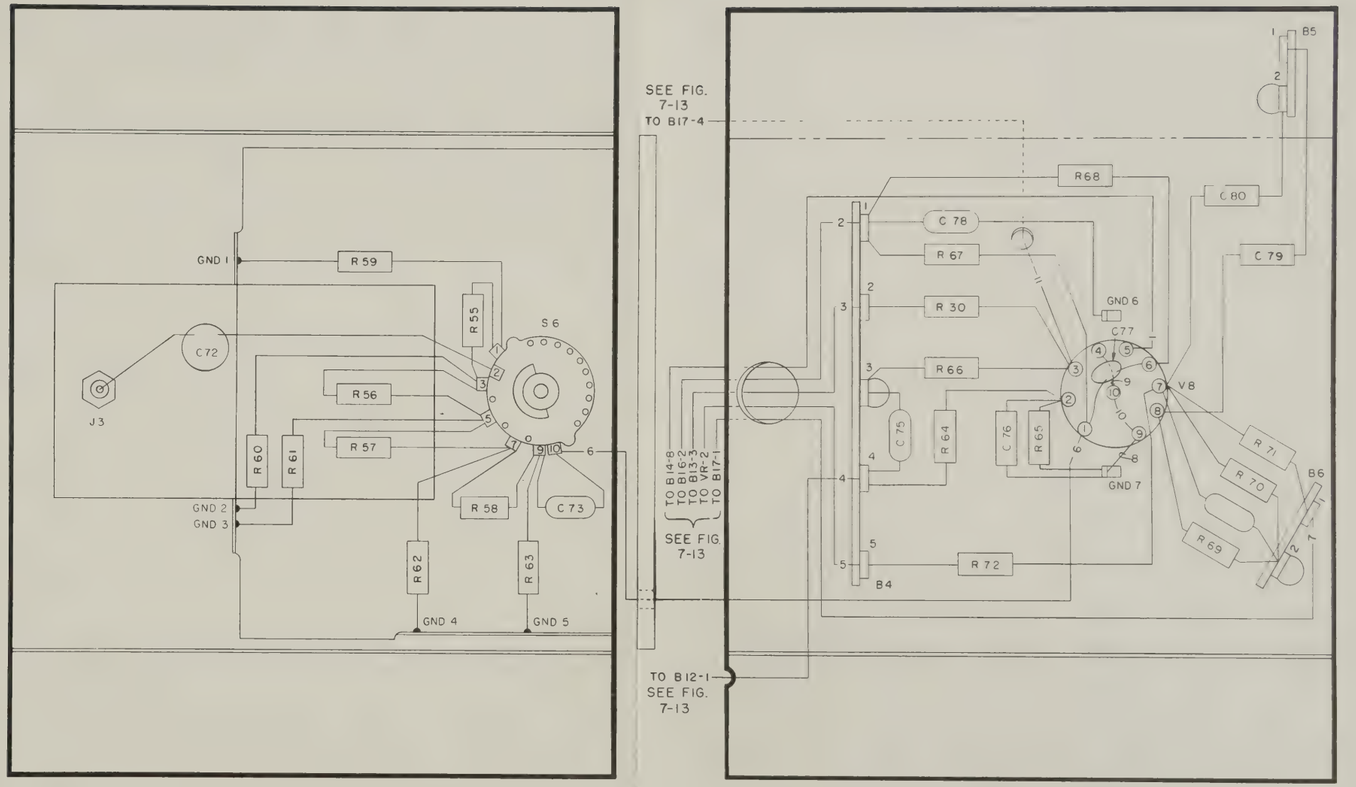


Figure 7-8. Output Attenuator-Mixer, Practical Wiring Diagram

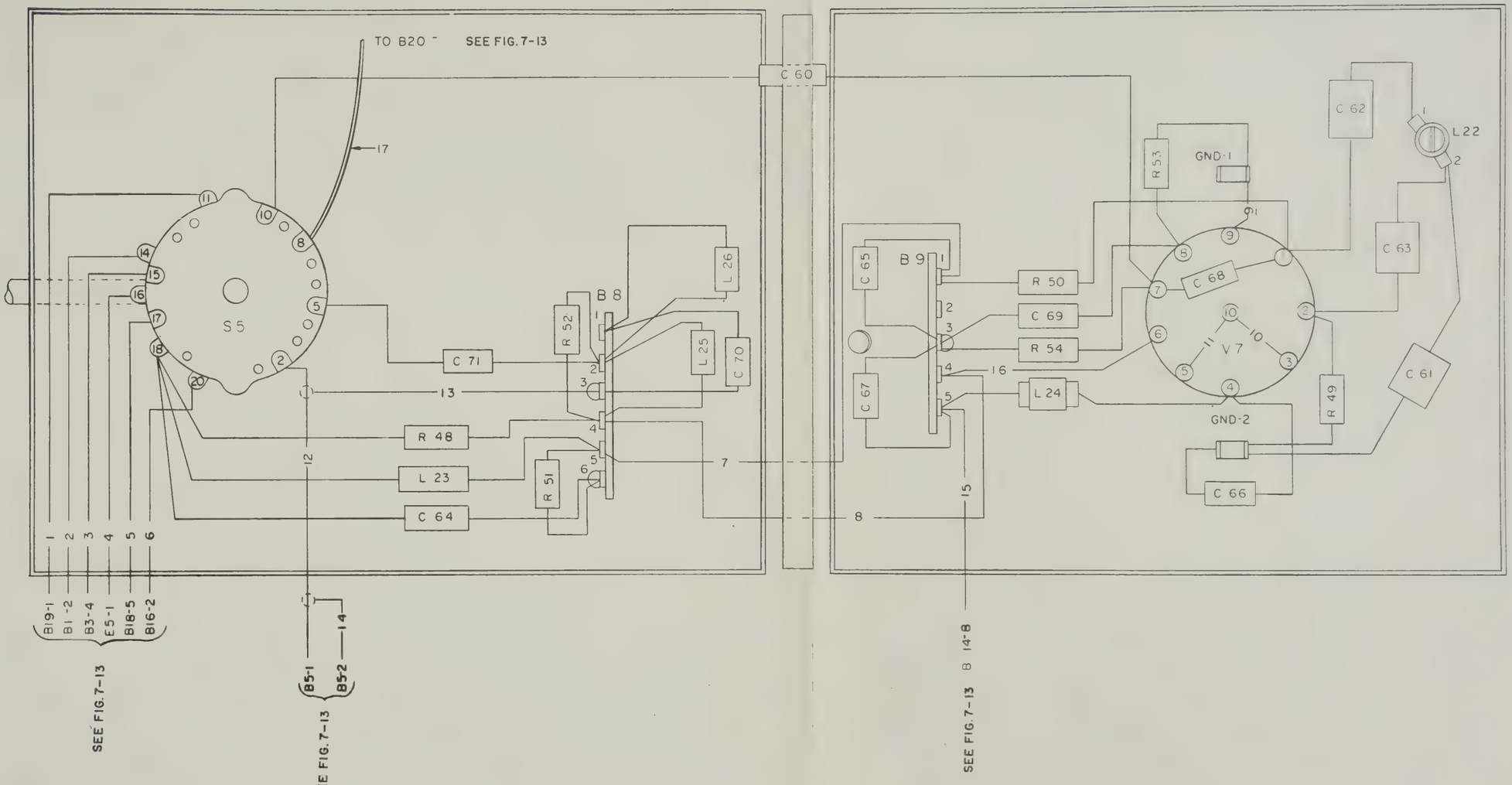


Figure 7-9. Sweep Converter, Practical Wiring Diagram

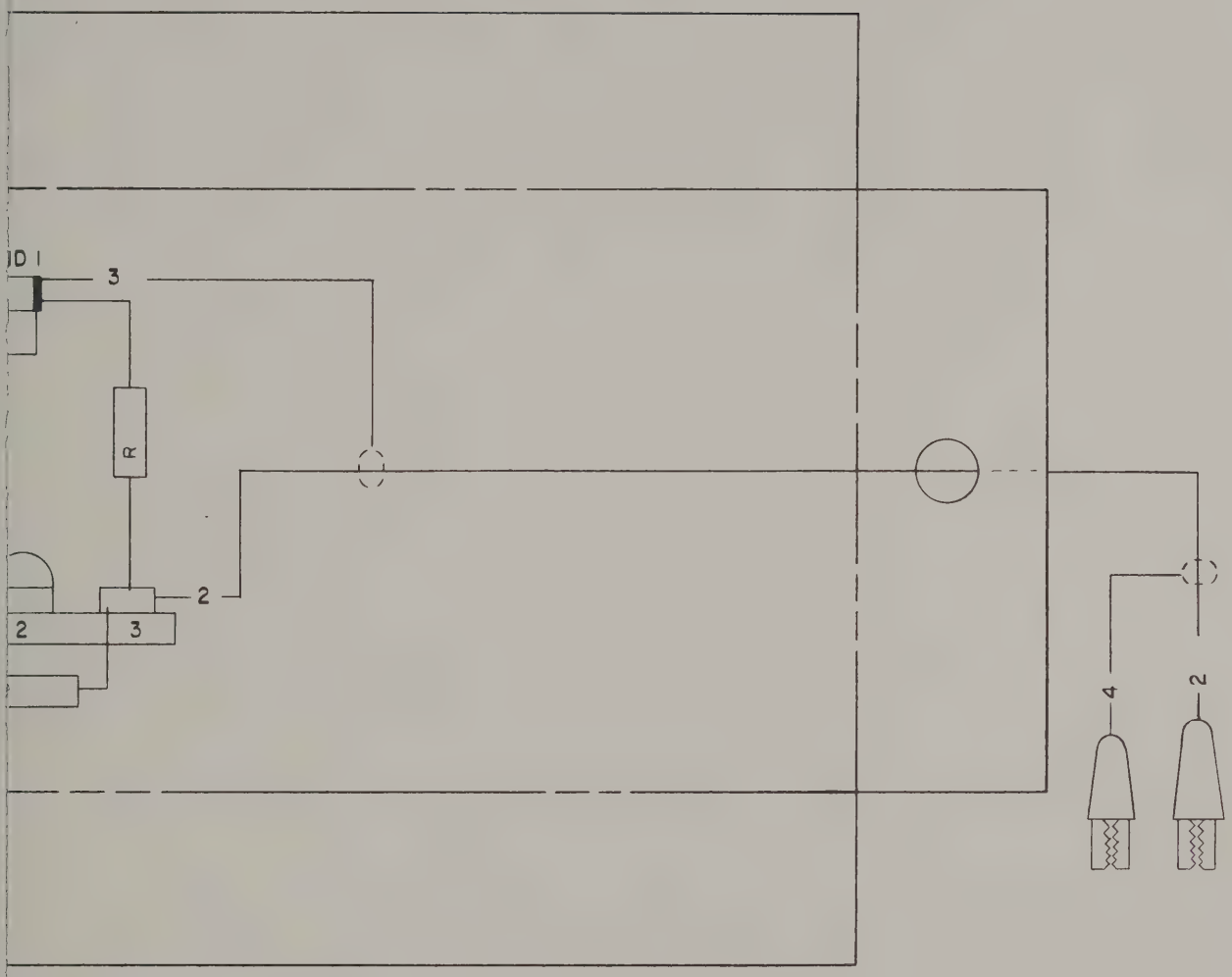


Figure 7-10. Detector-Box Assembly, Practical Wiring Diagram

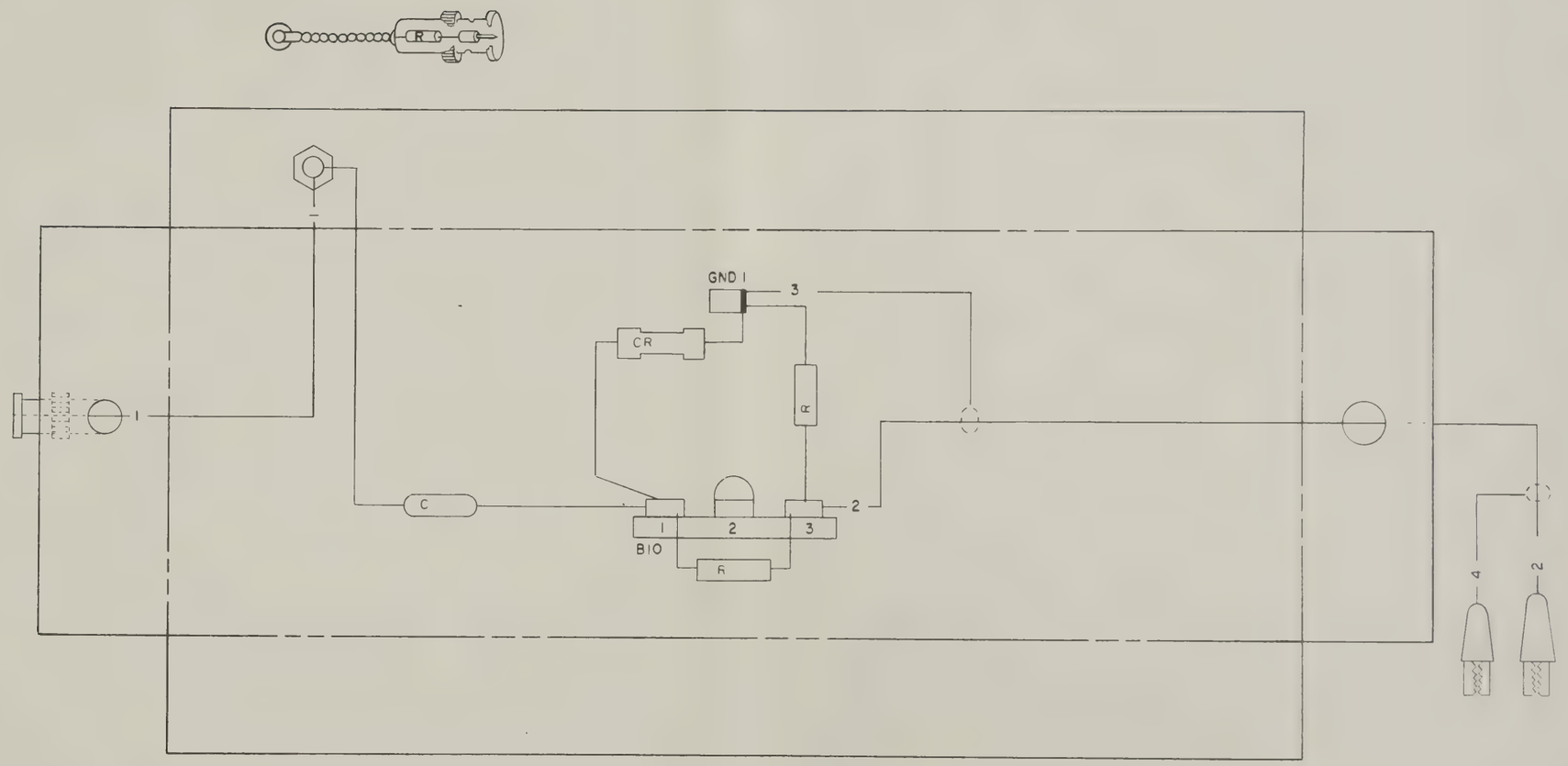


Figure 7-10. Detector-Box Assembly, Practical Wiring Diagram

E FIG. 7-13

WIRE LEGEND
A = COMPONENT WIRE

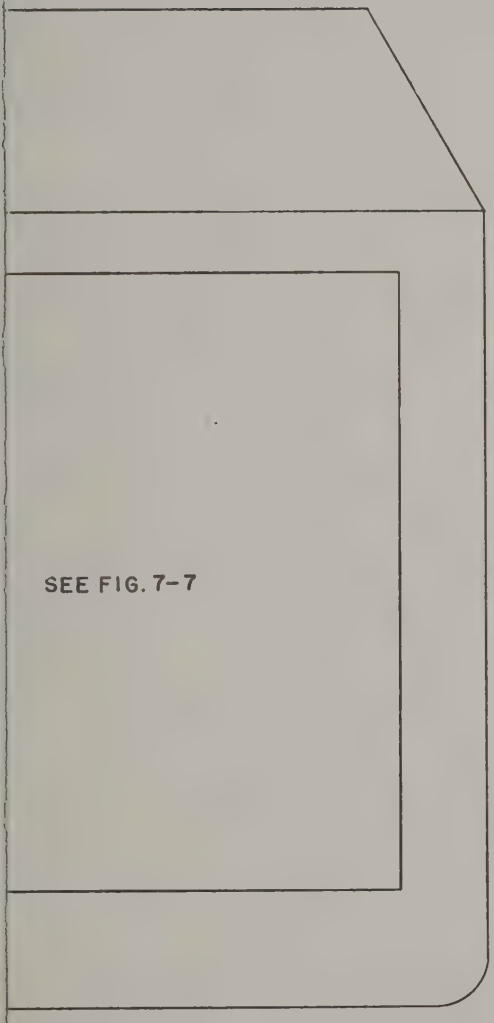


Figure 7-11. Support-Panel Assembly, Practical Wiring Diagram

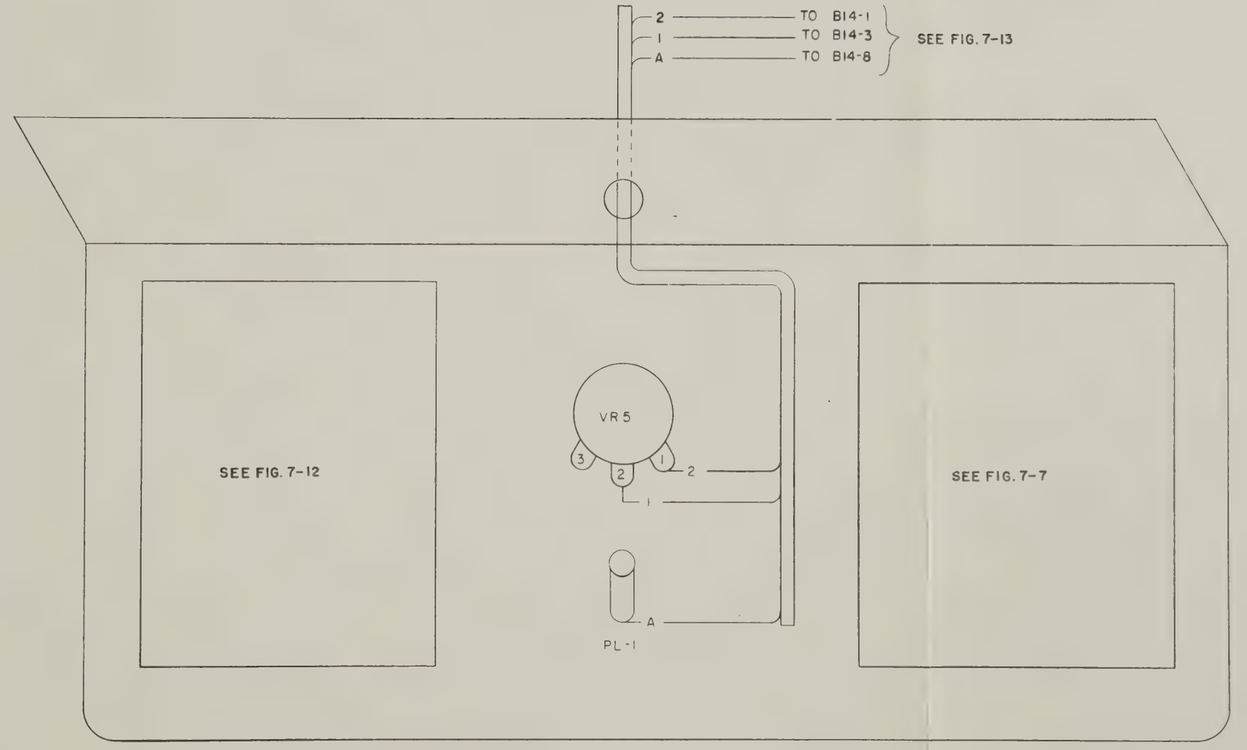


Figure 7-11. Support-Panel Assembly, Practical Wiring Diagram

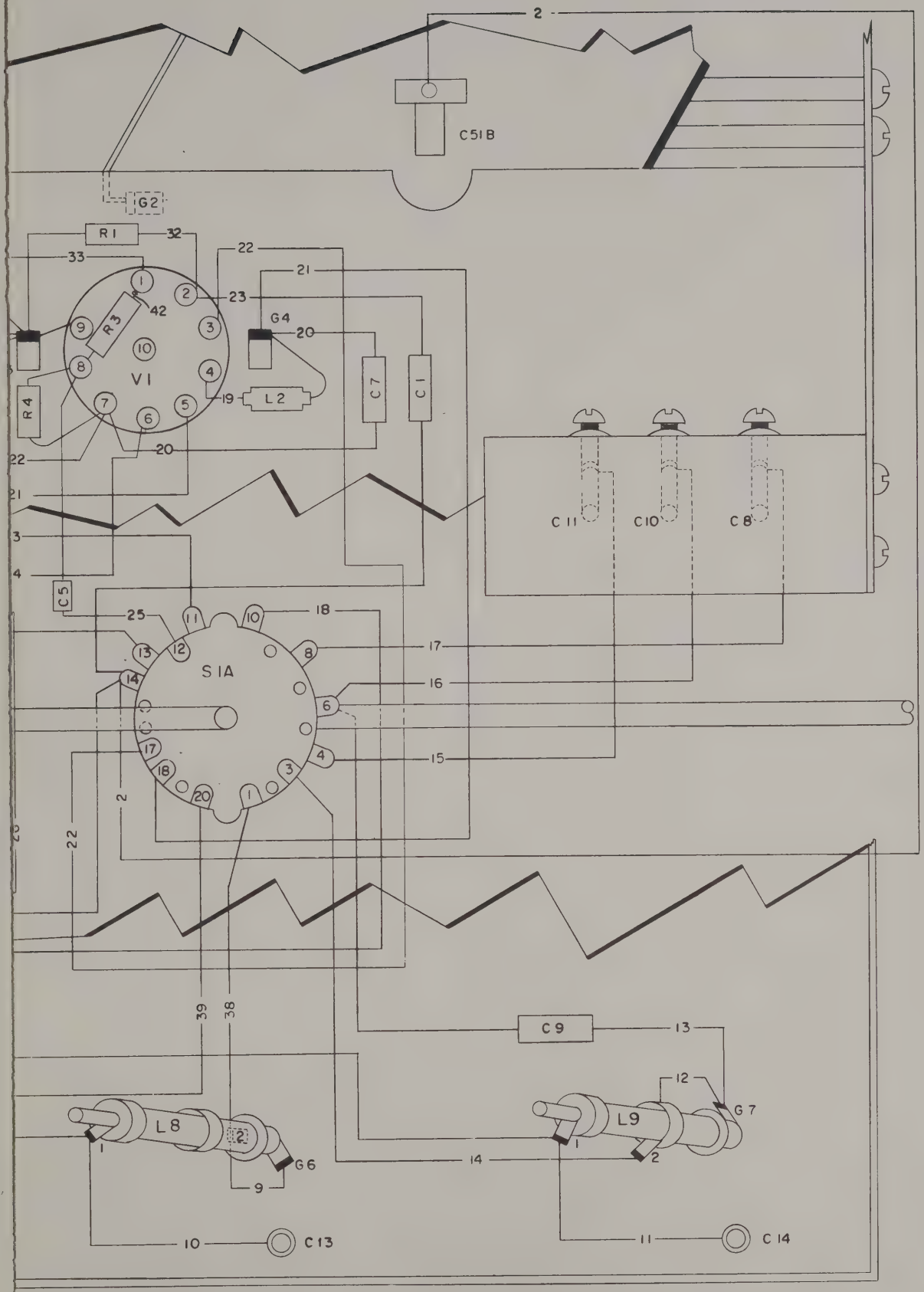


Figure 7-12. Marker-Oscillator Assembly, Practical Wiring Diagram

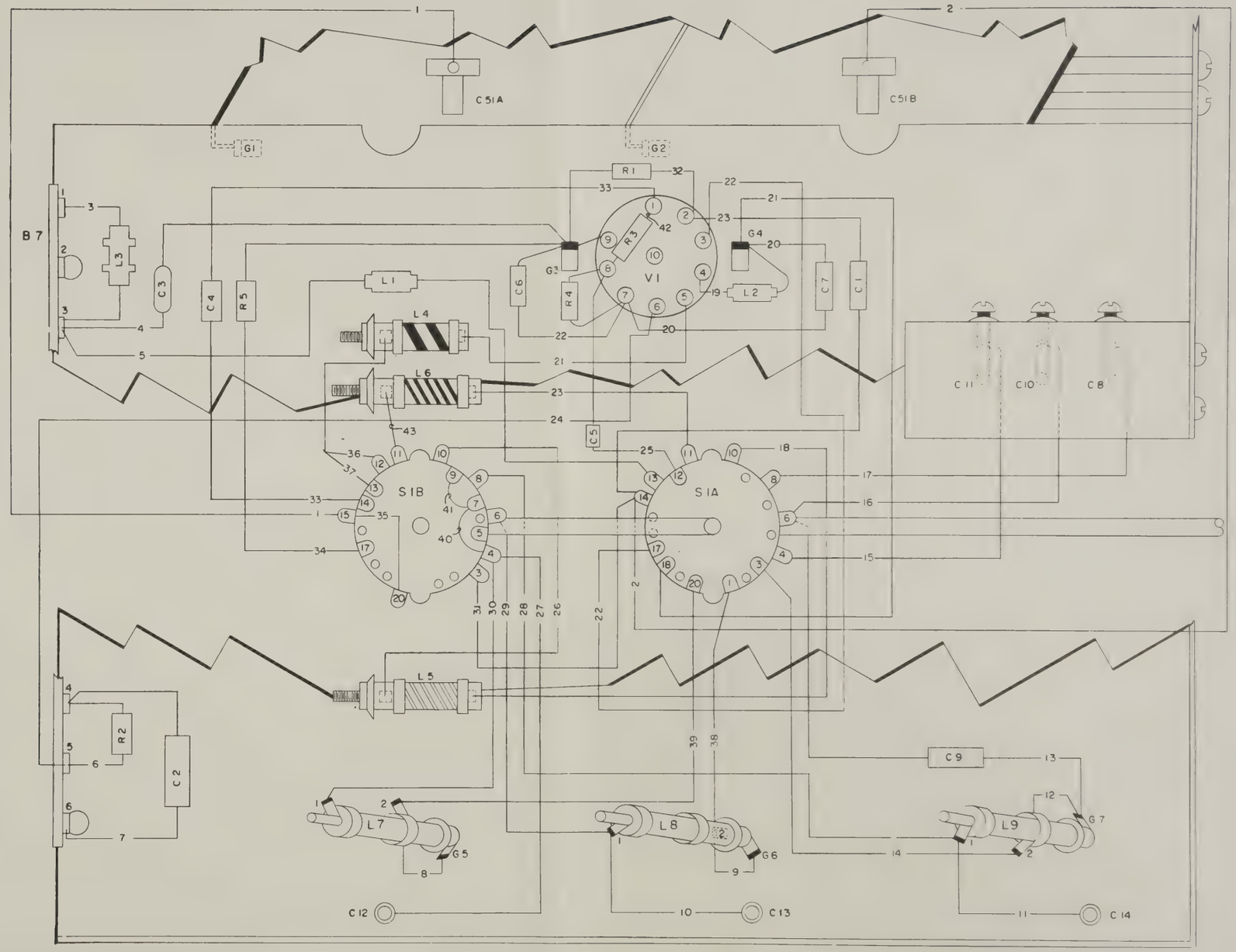


Figure 7-12. Marker-Oscillator Assembly, Practical Wiring Diagram

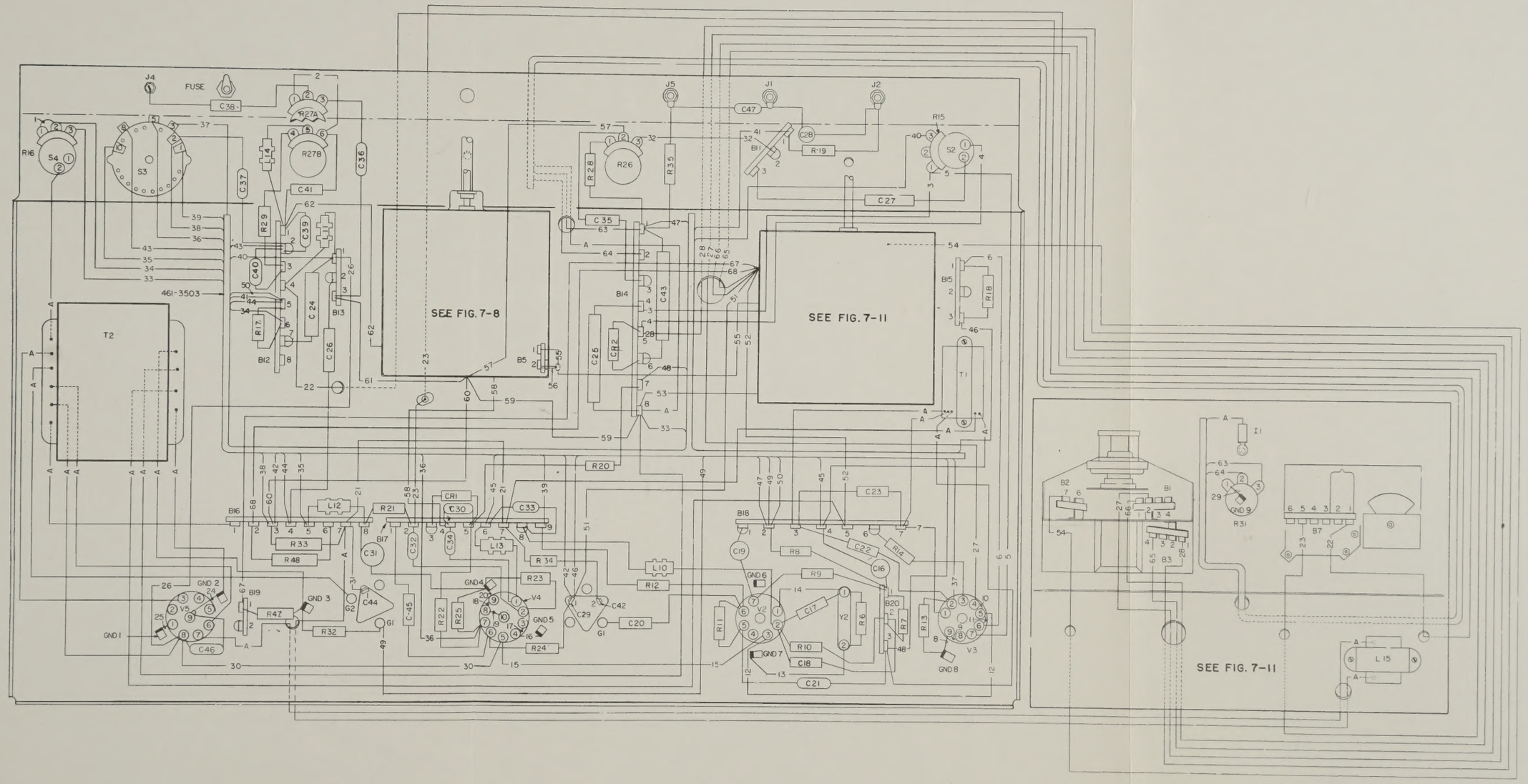


Figure 7-13. Generator, Sweep SG-93/URM-75, Over-all Practical Wiring Diagram

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